Onan®

BL

MAJOR SERVICE MANUAL

ONAN ELECTRIC GENERATING PLANTS

AK

SERIES

925-500

10AM71

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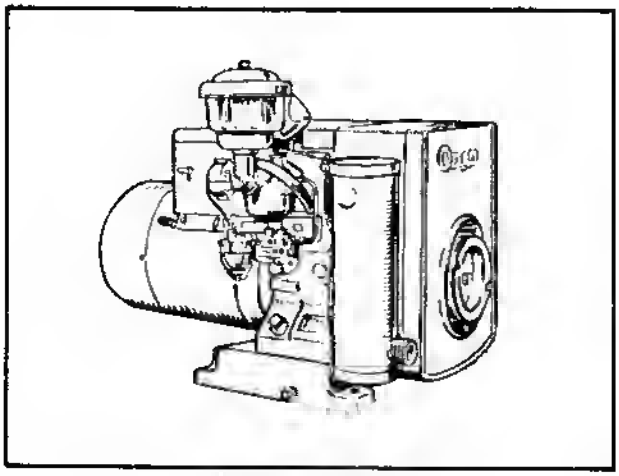


TYPICAL MODEL AK

INTRODUCTION

This manual contains the information necessary for properly servicing AK electric generating plants. Unless otherwise stated, these instructions apply to all standard plants of the AK Series. For installation, preparation and operating instructions, refer to Operator's Manual.

Plant electrical output characteristics appear on the nameplate, with the model designation and the serial numbers. The plant model and specification numbers are separated by by a diagonal line (/). The plant specification consists of a *number* which indicates optional equipment as ordered by the purchaser; and of a *letter* at the end, which is advanced to coincide with production modification by the manufacturer. Reference to the nameplate Specification letter may be necessary to select the instructions in this manual which apply to the model in question.

Some details of these instructions may not apply to special models having modifications specified by the purchaser. Due to the wide variety of uses for which these plants are suitable, these instructions must be of a general nature. However, by using the instructions and recommendations given in this manual as a general guide, it will be possible to properly service the plant.

Instructions for 60-cycle plants apply also for 50-cycle plants except for current frequency and operating speed. The engine end is designated as the *front end* of the plant. *Left side* and *right side* of the plant are determined by viewing from the front end.

DESCRIPTION

GENERAL

AK electric generating plants are a complete electric power plant, consisting of an internal combustion engine connected directly to a self-excited electric generator. Controls and accessories suitable for a normal installation are supplied.

Manual plants are designed for manual starting only, and can not be connected to batteries for electric starting. Remote control plants are designed for electric starting. When properly connected to a 12-volt battery, the plant may be started electrically at the plant, from one or more remote control switch points, or through automatic controls. Remote control plants have a built-in charging circuit for keeping the starting battery in a well charged conditron.

Each electric plant is given an actual running test at the factory and is carefully checked under various electrical load conditions before shipment, to assure that it is free of any defect and that it meets all performance requirements.

ENGINE DETAILS

TYPE: Vertical 1-cylinder, L-head, 4-stroke cycle.
BORE: 2-1/2"
STROKE: 2-1/2"
DISPLACEMENT: 12.2 cubic inches
HORSEPOWER: 1.85 at 1800 rpm
2.5 at 2400 rpm
3.7 at 3600 rpm
COMPRESSION RATIO: 5.5 to 1
CYLINDER & CRANKCASE: Integral, cast iron
MAIN BEARINGS: Precision sleeve type, babbitt faced, steel backed
CAMSHAFT BEARINGS: Precision sleeve type, babbitt steel backed
PISTON: 3-ring, aluminum alloy, full floating type piston pin
CONNECTING RODS: Aluminum alloy, integral bearing
LUBRICATION: Units 3000 rpm or over - Pressure, gear type oil pump
Units under 3000 rpm - Positive splash type
COOLING: Air, pressure flow (Vacu-flo optional)
SPEED CONTROL: Internal centrifugal flyball governor, external adjustments
IGNITION: Flywheel magneto, shielded system
FUEL: Gasoline (gas optional)

The exhaust valve is hardened chrome alloy-faced and seats on a hardened chrome alloy replaceable seat. A positive rotator for the exhaust valve (except on gas-fueled models) is used. Tappets are adjustable, self-locking,

GENERATOR DETAILS (Basic Models)

Revolving armature, self-excited generators are used on this series of generating plants. All have four poles except 3000- and 3600-rpm AC plants, which have two poles. A machined steel ring frame mounts the pole shoes and field coils. The armature is directly connected to the engine crankshaft through a taper fit and held in place by a stud which passes through the hollow center of the shaft.

AC Generators: Remote control models have an additional series winding which permits use of the generator as a motor for cranking the plant. The armature contains both ac and dc windings. (Manual plants, begin Spec. J, have rectifier excitation, and therefore have no dc windings). Direct current is used for energizing the field, and is also used to charge the starting battery, on a remote control plant.

DC Battery Charging Generators: The battery charging generator field is shunt wound and has an additional series winding which permits use of the generator as a motor for cranking the plant.

CONTROLS

AC Manual and Portable Plants: These plants are started by manually cranking with a pull rope (carburetors are manually choked). Electrical load is connected to the plant by plugging into receptacles mounted on the plant. Plants are stopped by pushing a stop button on the plant blower housing. These plants can not be connected to batteries for electric starting.

AC Remote Control Plant: Remote control ac plants are designed for electric starting. Remote control switches can be connected to provide for control of starting and stopping from convenient stations. Automatic (load demand) or load transfer (power failure) equipment can be connected for unattended control of starting and stopping. Certain models require the addition of an additional start disconnect relay for such service. The remote control plant, using battery power for cranking, provides a battery charging circuit. Some models are provided with a high-low charge rate

switch and ammeter - others have a single charge rate with no ammeter.

Battery Charging Plant: Battery charging plants are equipped for electrical starting at the plant. The control box is mounted over the generator and contains a reverse current diode, start solenoid, a charge rate ammeter, start switch, stop switch, and battery connection terminals. Battery charge rate is adjustable by changing the governed speed. The carburetor on electric start models is manually choked. On models modified for remote starting the carburetor is electrically choked.

TABLE OF TORQUES AND CLEARANCES

	Minimum		Maximum
Tappet - Intake Valve (at 70° F)	.010"		.012"
Tappet - Exhaust Valve (at 70° F)	.010"		.012"
Valve Face, Angle		44°	
Valve Seat, Angle		45°	
Valve Interference Angle		1°	
Valve Stem in Guide - Intake	.0010"		.0025"
Valve Stem in Guide - Exhaust	.0025"		.0040"
Crankshaft End Play	.008"		.012"
Crankshaft Main Bearing	.0030"		.0040"
Crankshaft Main Bearing Journal - Standard Size	1.6857"		1.6865"
Valve Seat Width	1/32"		3/64"
Camshaft Bearing	.0015"		.0030"
Connecting Rod Bearing	.0015"		.0025"
Crankshaft Rod Journal - Std Size	1.3742"		1.3750"
Piston Pin in Rod - 72°F	Thumb Push Fit		
Piston Pin in Piston - 72°F	Hand Push Fit		
Piston to Cylinder - Measured at bottom of skirt - 90° from pin	.004"		.005"
Cylinder Bore - Standard Size	2.502"		2.503"
Piston Ring Gap	.006"		.018"
Magneto Breaker Point Gap (full separation)		.022"	
Anti-Flicker Breaker Point Gap (full separation)		.020"	
Magneto Pole Shoe Air Gap	.010"		.015"
Spark Plug Gap - Gasoline Fuel		.025"	
Spark Plug Gap - Gas Fuel		.018"	
Ignition Timing Advance - 3000 & 3600 rpm		25°B.T.C.	
1800 rpm Plants		19°B.T.C.	
Cylinder Head Screw, Torque		24-26 lb. ft.	
Connecting Rod Screw, Torque		10-12 lb. ft.	
Oil Base		25-30 lb. ft.	
Timing Gear Cover		15-20 lb. ft.	
Flywheel to Crankshaft		35-40 lb. ft.	
Spark Plug		25-30 lb. ft.	

GENERAL

Refer to Trouble Shooting for assistance in locating and correcting troubles. If a major repair or overhaul becomes necessary, the engine should be repaired by a competent mechanic. Major generator repairs should be made by a competent electrician. Maintain factory limits and clearances, replacing worn parts when necessary. Disconnect battery when servicing control parts.

ONAN
GASOLINE ENGINE
TROUBLE-SHOOTING

TROUBLE	CAUSE
Failure to Start	Faulty Ignition - Clean, Adjust Points, Plug
Slow Starting	Out of Fuel - Check
Cranks Slowly	Battery Low or Discharged
Backfires at Carburetor	Lean Fuel Mixture, Adjust Carburetor
Engine Misfires Under Light Load	Fuel Mixture Too Rich - Check Choke Opening
Engine Misfires Under Heavy Load	Engine Flooded
Engine Misfires Under All Loads	Intake Air Leak
Low Oil Pressure	Poor Quality Fuel
High Oil Pressure	Spark Too Far Advanced - Retard Timing
Excessive Oil Consumption Blue Smoky Exhaust	Spark Plug Gap Too Narrow - Adjust Gap
Excessive Fuel Consumption Black Smoky Exh	Spark Plug Gap Too Wide - Adjust Gap
Engine Stops Unexpectedly	Low Compression
Engine Races	Clogged Carburetor
Engine Overheats (Air Cooled)	Fouled Spark Plug - Clean and Adjust
Mechanical Knocks	Leaking Valves or Valve Seats
	Broken Valve Spring
Speed Too Low	Light or Diluted Oil
Governor Hunts	Oil Level Too Low
Poor Governor Sensitivity	Sludge on Oil Cup Screen
No Governor Control	Oil Pump Badly Worn - Replace
Poor Compression	Oil Too Heavy
Burned Valves	Clogged Oil Passage
Piston, Cylinder and Ring Wear	Oil Relief Valve Stuck
Worn Connecting Rod Bushings Bearings	Defective Gauge
Sticking Valves	Poor Compression
	Wrong Bearing Clearance or Worn Bearings
	Dirty Air Cleaner
	Excessive Crankcase Pressure - Clean Breather Valve
	Governor or Throttle Linkage Out of Adjustment
	Loose or Corroued Battery Connections
	Brushes Worn or Making Poor Contact
	Dirty Points in Start Solenoid Switch
	Ignition Timing Wrong
	Poor Ventilation
	Blown or Leaking Head Gasket
	Low Engine Power
	Governor Spring Sensitivity Too Great
	Excessive Linkage Wear or
	Disconnected Linkage
	Loose Throttle Lever
	Wrong Valve Clearance
	Piston Rings Worn or Broken

ADJUSTMENTS

ADJUSTMENTS

Generating plant satisfactory performance is dependent upon correct adjustments. However, adjustments cannot fully compensate for low engine power, neglect of periodic servicing, etc.

GOVERNOR

The governor controls the engine speed. On AC generating plants, engine speed determines generator output voltage and current frequency. By increasing engine speed, generator voltage and frequency are increased, and by decreasing engine speed, generator voltage and frequency are decreased. An accurate voltmeter is required in adjusting the governor on AC plants. A small speed drop not noticeable without instruments will result in an objectionable voltage drop.

The governor arm is fastened to a shaft which extends from the gear cover, and is connected by a ball joint and link to the carburetor throttle arm. If the carburetor has been removed, or the governor disassembled, it may be necessary to re-adjust the governor.

A binding in the bearings of the shaft which extends from the gear cover, in the ball joint, or in the carburetor throttle assembly will cause slow governor action or poor regulation. Looseness or excessive wear in the governor mechanism will cause erratic governor action or an alternate increase and decrease in speed (hunting). A lean carburetor adjustment may also cause hunting. Springs of all kinds have a tendency to lose their calibrated tension through fatigue after long usage. If all governor and carburetor adjustments are properly made, and the governor action is still erratic, replacing the spring with a new one and resetting the adjustments will usually correct the trouble.

When the plant is stopped, tension of the governor spring should hold the carburetor throttle arm at the wide open position, pushed toward the generator end of the plant. At wide open position, the lever on the throttle shaft should just touch the carburetor body or clear it by no more than 1/32". This setting can be obtained by increasing or decreasing the length of the connecting linkage as necessary by turning the ball joint on the threads of the link. Be sure to retighten the ball joint to the governor arm. This operation synchronizes governor action with carburetor throttle action.

Adjusting the Governor (AC Plant): Refer to Figure 1. Con-

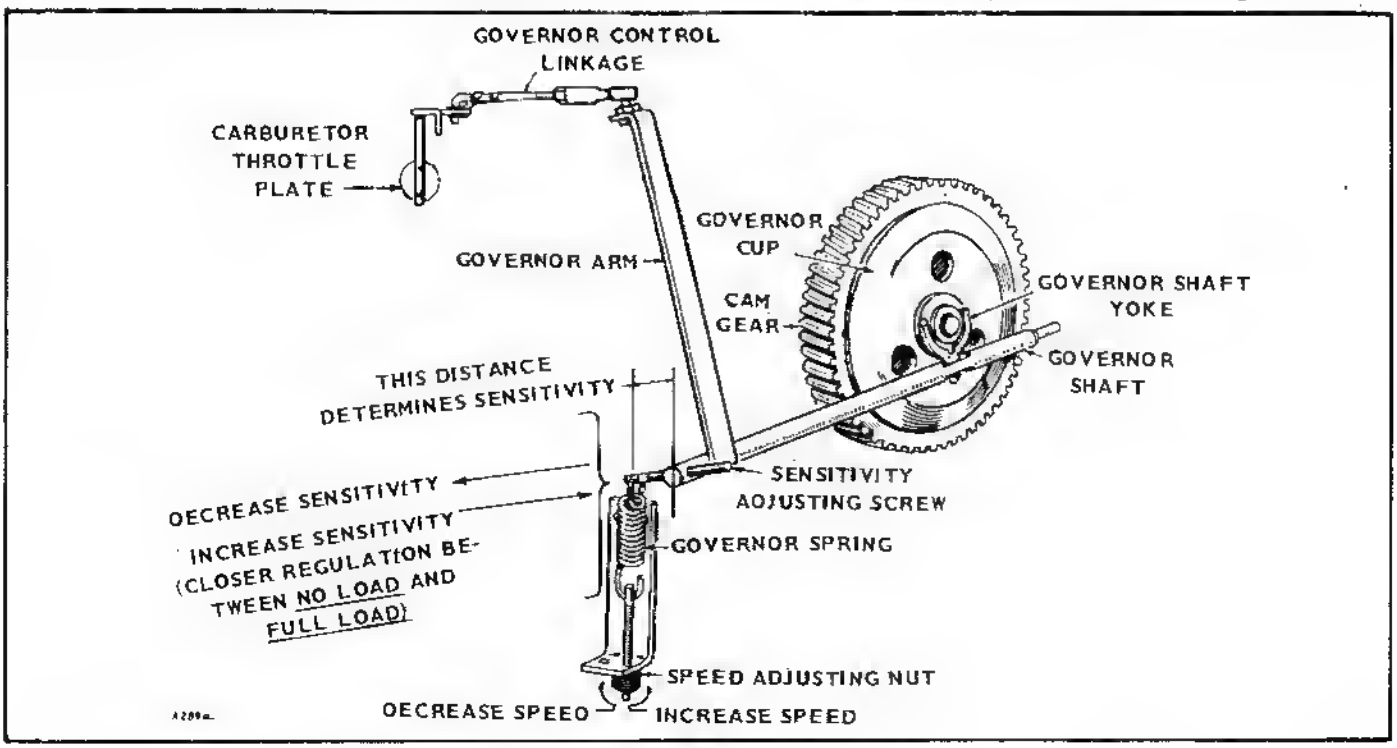


FIGURE 1. GOVERNOR ADJUSTMENTS

nect a voltmeter across the output of the generator. With no electrical load connected, start the plant and adjust the speed adjusting nut to give a voltmeter reading of approximately 126 volts maximum for a 120-volt plant. Apply a full rated electrical load and again observe the voltage reading, which should be approximately 108 volts. For 240-volt plants, 252 volts at no-load is maximum and 216 volts full-load is minimum. The correct sensitivity adjustment gives the closest regulation without causing a hunting condition. If the voltage spread between no-load and full-load conditions is too great, move the end of the governor speed spring closer to the governor shaft. Test the governor action at various load conditions. If voltage regulation is good, but there is a tendency toward hunting at times, the sensitivity adjustment is too close or sharp and the sensitivity stud must be turned outward slightly. Any change in the sensitivity adjustment will require a speed re-adjustment.

If a tachometer is used for adjusting the governor, engine speed at full-load for a 60-cycle plant should be approximately 1800 rpm for a 4-pole generator, or 3600 rpm for a 2-pole generator, with a spread of not more than 100 rpm between no-load and full-load for an 1800-rpm unit (200 rpm for a 3600-rpm unit). Engine speed at full load for a 50-cycle plant should be approximately 1560 rpm for a 4-pole generator, or 3000 rpm for a 2-pole generator.

Adjusting the Governor (Battery Charging Plant): To adjust the governor on battery charging generators, turn the knurled speed adjusting nut (spring tension nut) to give the desired charge rate. The rate of charge is shown on the control box ammeter. The ability of the governor to keep the charge rate steady at the desired rate depends upon the distance between the center of the governor arm shaft and the governor arm end of the spring. If the governor tends to "hunt" or alternately increase and decrease speed, turn the sensitivity adjusting stud outward to move the end of the spring slightly further from the center of the governor shaft. Any change in the sensitivity adjustment will require a compensating change in the speed (spring tension) adjustment. Increasing sensitivity results in a slight decrease in engine speed. The desired adjustment is a setting which gives the closest regulation without hunting. Maximum speed at full load operation of battery charging plants is approximately 2400 rpm, as specified on the nameplate.

AUTOMATIC IDLE ADJUSTMENT

Some 3600-rpm models are equipped with a special idle device to drop engine speed to approximately 1800 rpm when the plant is operating at no-load. The idle device automatically restores operating speed when an electrical load (100 watts or more) is connected.

Refer to Figure 2. Temporarily disconnect the flexible joint A from the lever B. The socket part slips off the ball part. Snap the idler switch, on the outlet box, to its OFF position. Adjust the governor for normal 3600-rpm operation under no-load to full-load conditions, with nuts H loosened. Tighten lock nuts H, with spring E as close to the end of the sensitivity screw as possible. Reconnect Joint A to lever B. Turn stop adjusting screw F down for maximum lever movement.

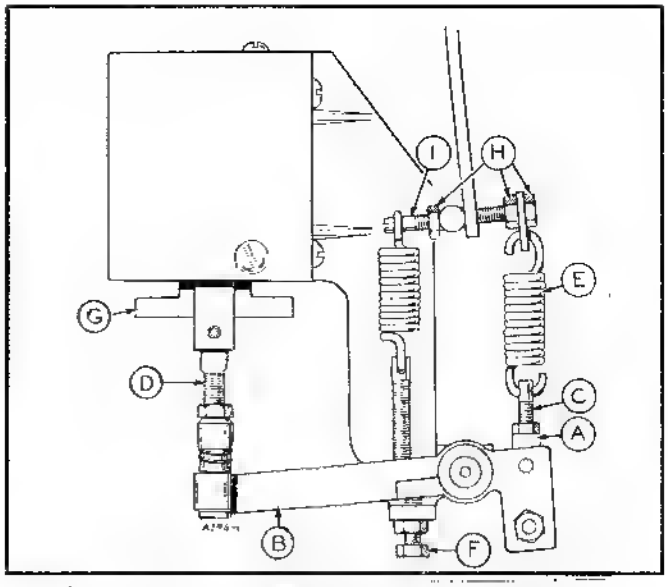


FIGURE 2. AUTOMATIC IDLE ADJUSTMENT

Snap the idler switch to its ON position. With all electrical load removed, the solenoid should pull up and provide sufficient tension on spring E to over-ride the tension of the regulating governor spring and reduce the engine speed to about 1800 rpm. If idle speed is too high, linkage C or D is too long. If idle speed is too low, linkage C or D is too short. With a full electrical load connected, the solenoid plunger should drop downward. Adjust screw F to just provide no tension on spring E, but without the spring being too loose. Be sure all lock nuts are tightened.

NOTE: *Never operate the plant with the solenoid plunger removed or unable to close completely unless the control toggle switch is at its OFF position.*

ANTI-FLICKER MECHANISM

The anti-flicker mechanism (Fig. 3) is used on 1500- or 1800-rpm ac plants, to compensate for the power surge during the power stroke of the engine. The breaker points, located on the left side of the crankcase just behind the gear cover, are connected to a generator field resistor. A

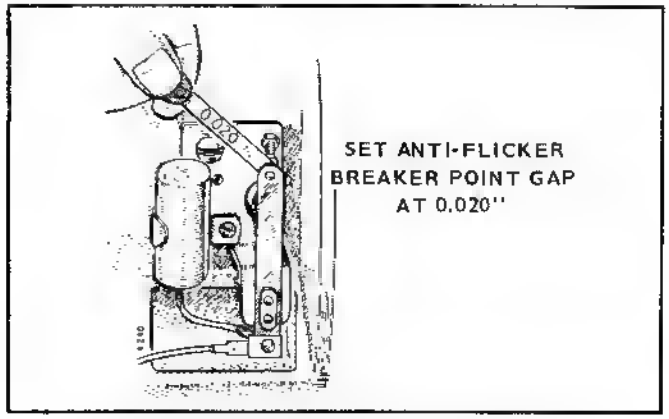


FIGURE 3. ANTI-FLICKER POINT SETTING

condenser connected across the breaker points prevents sparking and burning of the contacts.

Burned or pitted contact points are usually an indication of a defective condenser. The breaker point gap at full separation should be 0.020". If points and condenser are in good condition, but light flicker is excessive, check for a defective resistor.

CARBURETOR

A small piece of foreign matter lodged in a jet may cause hard starting and poor operation. Dirty gasoline may cause the jets to wear larger, resulting in excessive gasoline consumption. Before tampering with jet settings, mark the existing adjustment or count the number of turns the needle was backed out from its seat.

The carburetor is a side (horizontal) draft type and has two adjusting needles. The "idle" needle is located nearer the cylinder head. The "main" needle is located on the top nearer the air cleaner. Turning a needle inward gives a leaner fuel mixture for that jet. See Figure 4.

The correct setting for the main jet needle gives the best stability at full rated load operation. The correct setting for the idle needle gives the best stability at no-load operation.

Starting with Spec K, a different carburetor is used. Basic adjustments (idle jet, main jet, float level, etc.) are the same for the new style as for the old. Only the location of adjusting needles, etc. is different. Figure 5 shows this carburetor.

Full-load and no-load operating conditions are necessary when making carburetor adjustments.

To obtain a full rated load condition on alternating current plants, connect an ac load equal to the watts or amperes shown on the nameplate.

To obtain a no-load condition, disconnect all ac load, leaving starting batteries (where used) connected and with governor properly adjusted.

To obtain a full rated-load condition on battery charging (dc) plants, leave batteries connected and increase engine speed to the point where the ammeter reading compares with rated amperes shown on the nameplate. To obtain a no-load condition, leave batteries connected and decrease engine speed to the point where the ammeter reading is zero, or as low as possible.

To adjust the carburetor, turn the adjusting needles in gently (finger tight) to their seats. Do not force them in, as they may be damaged by seating too tightly. Back the main needle out about 2-1/2 full turns. Back the idle needle out 3/4 of a turn. Start the plant and allow it to thoroughly warm up under a full-load condition.

Slowly turn the main adjusting needle inward (clockwise) for leaner mixture, until the plant begins to lose speed, or the voltage drops. Turn the needle outward (counterclockwise) to the point where the plant will carry the full-load. Check the operation at various loads. If there is a tendency to hunt (alternately increase and decrease speed) at any load, turn the adjusting needle out for richer fuel mixture, until the hunt is corrected, but do not turn the adjusting needle out more than 1/2 turn beyond the point where maximum generator output is obtained. Adjust the idle needle with the plant warm, with batteries connected, and with no ac electrical load connected or while at lowest possible charge rate as the case may be, depending upon the type of plant in question. Slowly turn the idle adjusting needle inward (clockwise) until the plant loses speed from lack of fuel. Then turn the needle slowly outward until the plant runs smoothly.

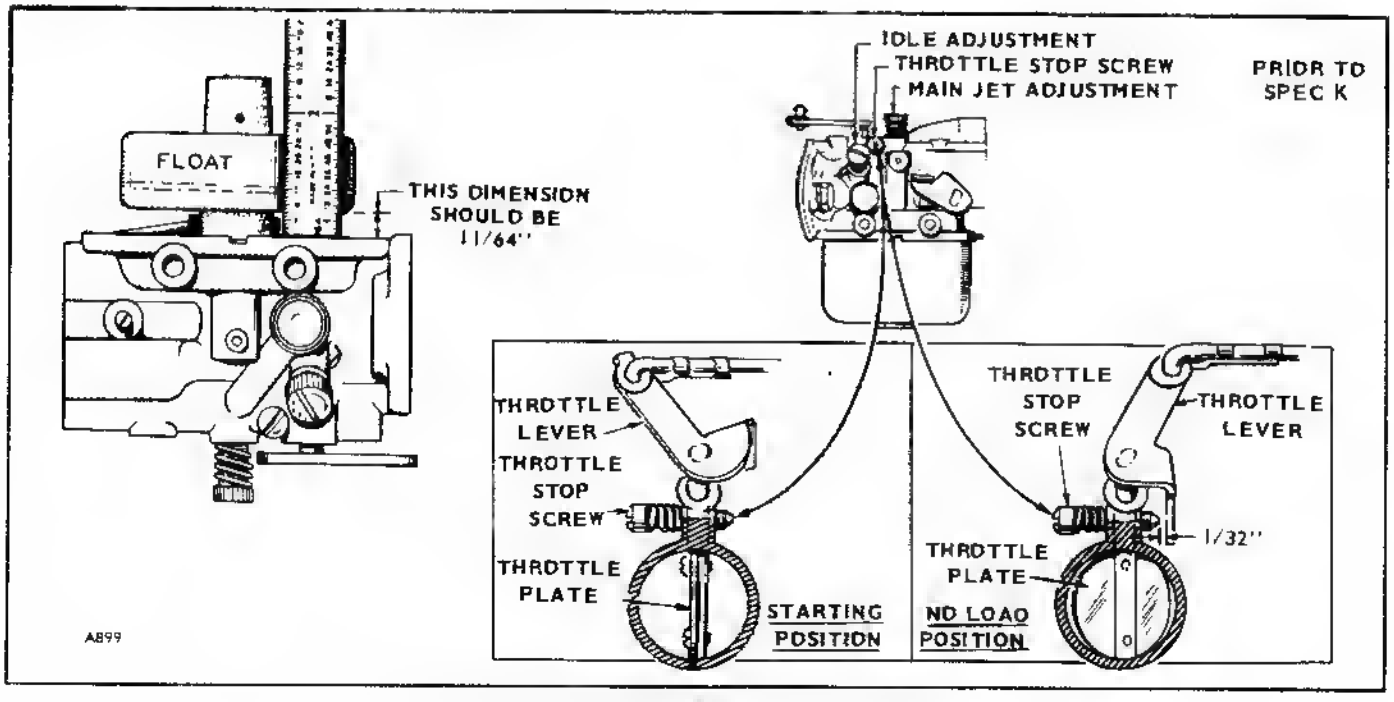


FIGURE 4. CARBURETOR ADJUSTMENTS

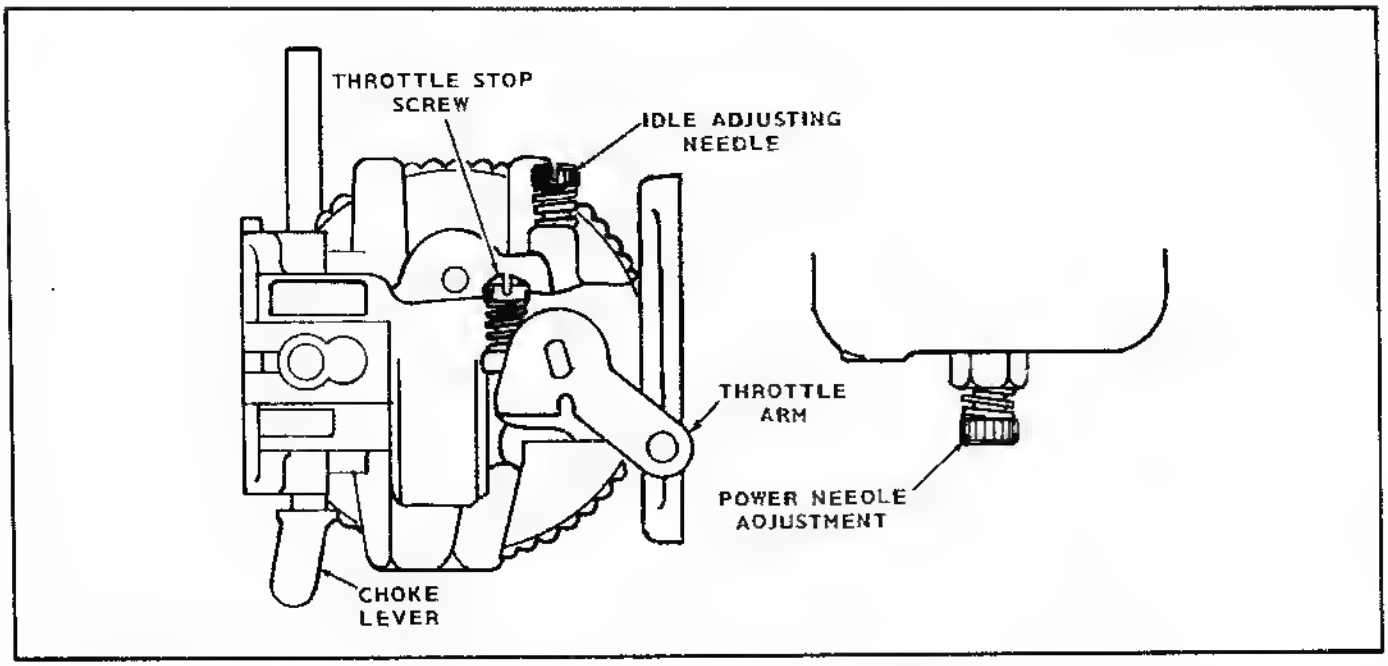


FIGURE 5. CARBURETOR, SPEC F AND LATER

The throttle idle stop screw should be adjusted to clear the throttle shaft stop by 1/32" when the plant is operating at desired speed and no-load condition. This setting helps prevent hunting during changes in load.

CARBURETOR FOR GAS FUEL ONLY

To adjust the gas fuel carburetor, set the main adjusting screw approximately 1-1/2 turns open, and set the idle adjusting screw approximately 1-1/4 turns open to permit starting the engine. Follow the procedure given for gasoline carburetor in the preceding section to complete the adjustments.

The weighted carburetor choke (except Spec K) should just close, but must be free to open with the air stream during operation. Some chokes are fitted with an adjusting screw. Turn in for less choking action; turn out for more choking action.

GAS REGULATOR

The regulator was factory adjusted to lock-off at a pressure of 4 ounces (7" water column). It will operate satisfactory at incoming pressures between 2 and 4 ounces. If your gas supply pressure is within these limits, no regulator adjustment is required. If your gas supply pressure is under 2 ounces, the regulator will not operate. If your gas supply pressure is between 4 and 8 ounces, install an appliance regulator set for 2 ounces ahead of the regulator or adjust the regulator as follows: (Refer to Fig. 6).

CAUTION A soap bubble placed over the regulator outlet will not accurately test the regulator lock-off. The soap bubble resistance, when multiplied by the greater area of the diaphragm, is enough to shut off this very sensitive demand-type regulator. A manometer must be used to show complete regulator shut-off.

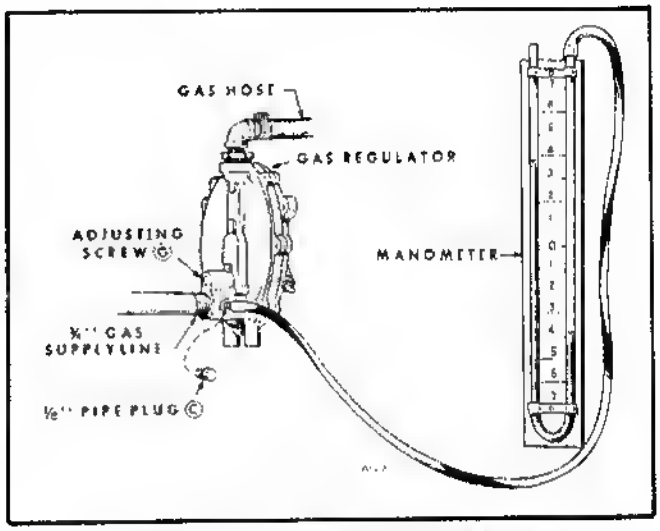


FIGURE 6. MANOMETER CONNECTION

1. Use a manometer which reads up to 14" water column. (Note: 1 ounce per square inch equals 1.73" water column. Likewise water column equals 0.58 ounces per square inch).
2. Remove 1/8" pipe plug (C) and connect manometer.
3. With gas supply on and hose removed, alternately cover and uncover the regulator outlet with your hand. If the regulator locks-off completely, as desired, the manometer will hold a steady reading. If the manometer reading drops slightly each time you remove your hand, the regulator is leaking.
4. When necessary, adjust the lock-off screw (G) as follows: Turn the adjusting screw (G) inward just far enough so that manometer reading remains constant when you repeatedly cover and uncover the regulator outlet with your hand.
5. Operate the engine to ensure quick starting results.

ELECTRIC CHOKE

AC remote control plants are equipped with a thermal-action electric choke. A thermostatic coil (bi-metal) engages the choke shaft and is set at the factory to give the correct choking action for average temperature conditions. When the plant starts, current from the generator is supplied to a small heating element in the choke cover. This heating element causes the thermal coil to wind tighter and turn the choke shaft, gradually opening the choke as the plant warms up. When the plant is stopped, the thermal coil cools off, causing the choke shaft to return to the correct position for the next start.

At a temperature of 70°F., the choke should be approximately 1/8" from the fully closed position. The thermal coil tends to coil tighter when heated.

Extreme temperature may require a slight adjustment of the choke setting. To adjust the choke, loosen the two screws which retain the choke cover to the body choke. For less choking action, turn the cover assembly slightly in a counter-clockwise direction. See Fig. 7.

If the choke does not operate properly, check to see that the heating element heats properly. There must be no binding of the choke shaft or thermal coil. Be sure to tighten the lock screw after any adjustment.

A manual-operating lever and weight, fastened on the opposite end of the choke shaft, may be used to operate the choke in the event the electric element burns out or the choke does not operate for any reason. Turn the lever to its horizontal position to open the choke. Choking position of the lever is vertical. However, choking position on manually choked plants is horizontal.

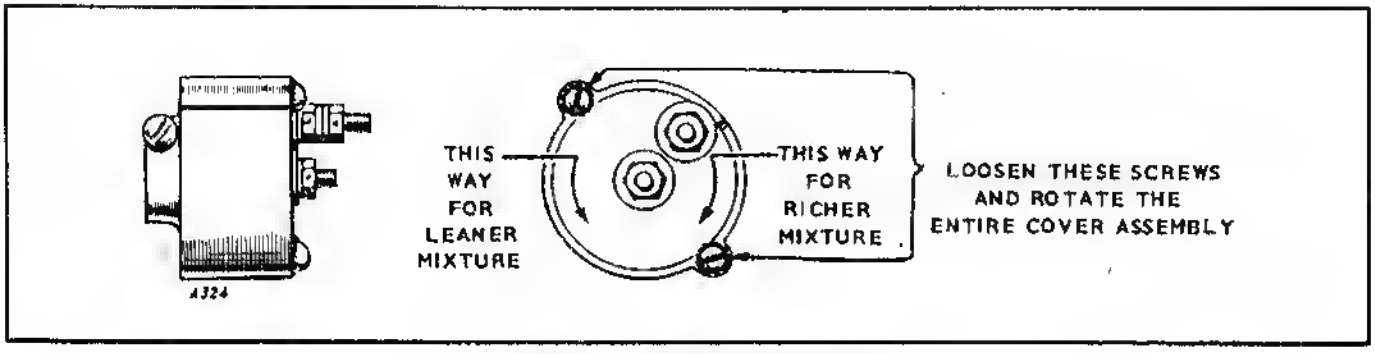


FIGURE 7. CHOKE ADJUSTMENTS

FUEL PUMP

The engine uses a diaphragm-type fuel pump. If fuel does not reach the carburetor, check the fuel pump before dismantling it.

1. Disconnect the fuel line at the carburetor.
2. Crank the engine slowly by hand and observe whether fuel comes from the line at the carburetor.

   WARNING *Be sure to direct the fuel flow into a container so gas does not spill on ignition wires.*
3. If there is enough fuel in the tank, and the line between the tank and the pump is open but the pump fails, repair or replace it.

Failure of the pump is usually due to a leaking diaphragm, valve or valve gasket, a weak or broken spring, or wear in the drive linkage. If the operator chooses to repair the pump rather than install a new one, use a complete repair kit.

Gasoline diluted oil may indicate a faulty fuel pump.

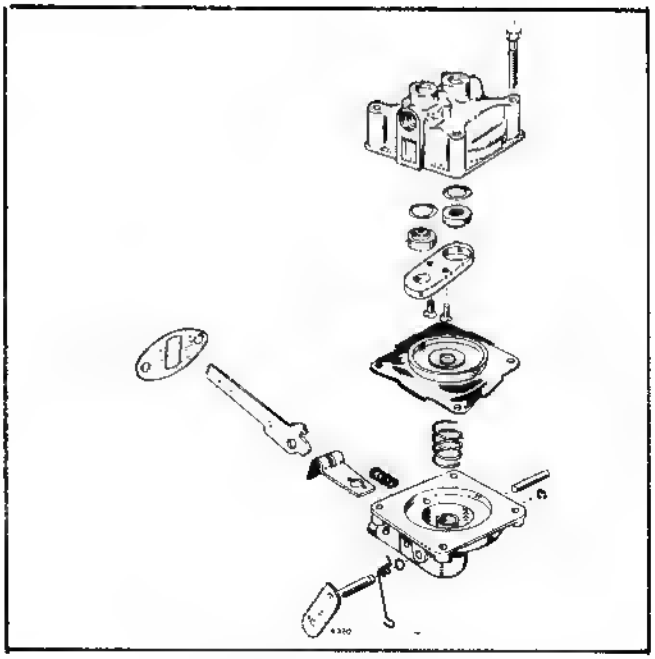


FIGURE 7A. FUEL PUMP

ENGINE MAINTENANCE AND REPAIR

CARBURETOR

Carburetor maintenance should consist of regular cleaning. Some gasolines have a tendency to form gum deposits inside the carburetor. This gum formation can usually be removed by soaking in alcohol or acetone. A fine soft wire may be used to clean jets.

Carburetor adjustments appear in the adjustment section. See that the float is not damaged. Be sure the throttle assembly works freely. When installing adjusting needles, do not force them into their seats. The carburetor for 3600 rpm plants has a larger venturi (early models only) than other models.

MAGNETO

The high tension magneto supplies ignition current to the spark plug. Proper ignition timing is accomplished by a breaker mechanism actuated by a cam on the crankshaft. To test the spark, disconnect the cable from the spark plug and support it so that the end of the wire is 3/16″ from a clean metal part of the engine. Crank the engine with the hand rope, observing the spark, which should jump the 3/16″ gap with ease. If there is no spark, or a spark that is weak or yellowish in color, make repairs as necessary.

Remove the air housings and blowerwheel on Vacu Flo

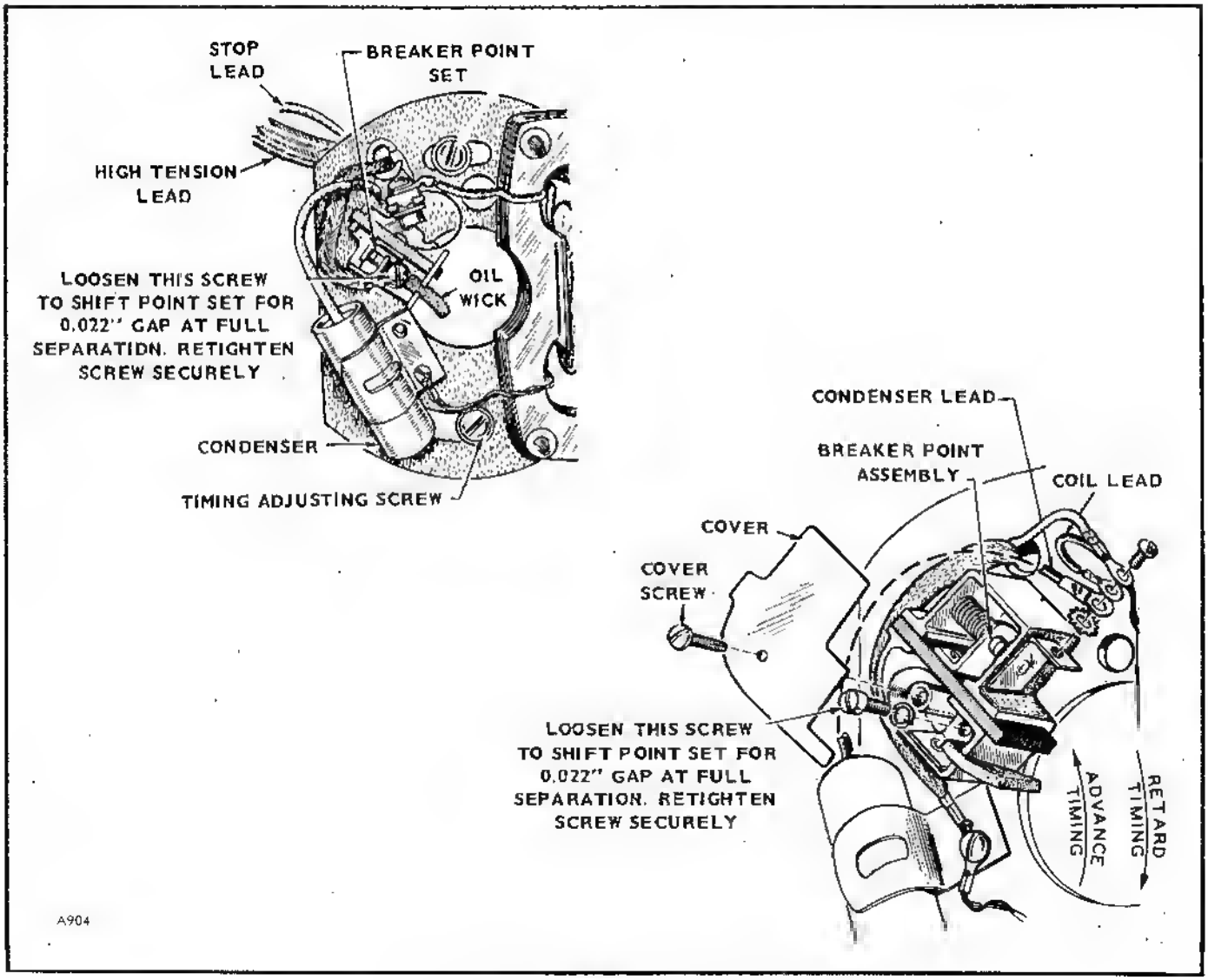


FIGURE 8. SETTING MAGNETO POINTS

units or just the blower housing on pressure cooled units. Loosen the flywheel bolt a few turns. While pulling or prying outward on the flywheel, strike the flywheel bolt a sharp endwise blow to loosen the flywheel. Remove the flywheel bolt and carefully pull the flywheel off the crankshaft. Examine the magneto breaker contact points. Contact points which are not badly burned or pitted may sometimes be dressed smooth with a thin flexible abrasive stone or removed and dressed on any fine stone or hone. Badly burned or pitted points should be replaced with new ones. Adjust the gap between points at full separation as given in the Table of Clearances. A defective condenser must be replaced with a new one of proper capacity. A flywheel magnet which has lost its magnetism can be remagnetized. If the magneto backplate has been loosened or removed, see that the gap between the coil poleshoes and the flywheel is .010 to .015". Too wide an air gap will produce a weak spark.

TIMING THE IGNITION

Proper ignition timing is important for good engine operation. Refer to the Table of Clearances for the correct degree of spark advance before top center (TC) position of piston travel. If available, use a series type test lamp for accuracy. See Figure 8 for timing information.

See that the point gap is properly adjusted. Install the flywheel loosely, with its key in place, and turn the flywheel with rotation direction to the position where the mark on the edge of the flywheel is in alignment with the proper degree on the gear cover. Effective early in 1969, the correct timing mark is painted, to aid in timing. The points should just separate at this point. If they do not, remove the flywheel and loosen the magneto backplate mounting screws slightly. If the points separate too soon, shift the entire backplate assembly slightly in a counterclockwise direction. If the points do not separate soon enough, shift the entire backplate assembly clockwise. Tighten the backplate mounting screws and recheck the work for accuracy. When replacing the flywheel, always make sure the key is properly in place on the crankshaft.

VALVE SERVICE

Properly seated valves are essential to good engine performance. The aluminum cylinder head is removable for valve servicing. Do not use a pry to loosen the cylinder head, rap sharply on the edge with a soft faced hammer, taking care not to break any cooling fins. A conventional valve spring lifter may be used when removing the valve spring locks. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. If a valve face is burned or warped, or the stem worn, install a new valve.

Worn valve stem guides may be replaced from inside the valve chamber. This gasket (early models only) must contact tightly against the upper valve chamber surface. Valve locks are the split, tapered type, the smaller diameter of which must face toward the valve head. Tappets are also replaceable from the valve chamber, after first removing the valve assemblies.

The valve FACE angle is 44°. The valve SEAT angle is 45°. This 1° interference angle results in a sharp seating surface between the valve and the top of the valve seat. The interference angle method of grinding valves minimizes face deposits and lengthens valve life (Fig. 9).

Valves should not be hand lapped, if at all avoidable, since the sharp contact may be destroyed. This is especially important where stellite-faced valves and seats are used. Valve faces should be finished in a machine to 44°. Valve seats should be ground with a 45° stone, and the width of the seat band should be 1/32 to 3/64" wide. Grind only enough to assure proper seating.

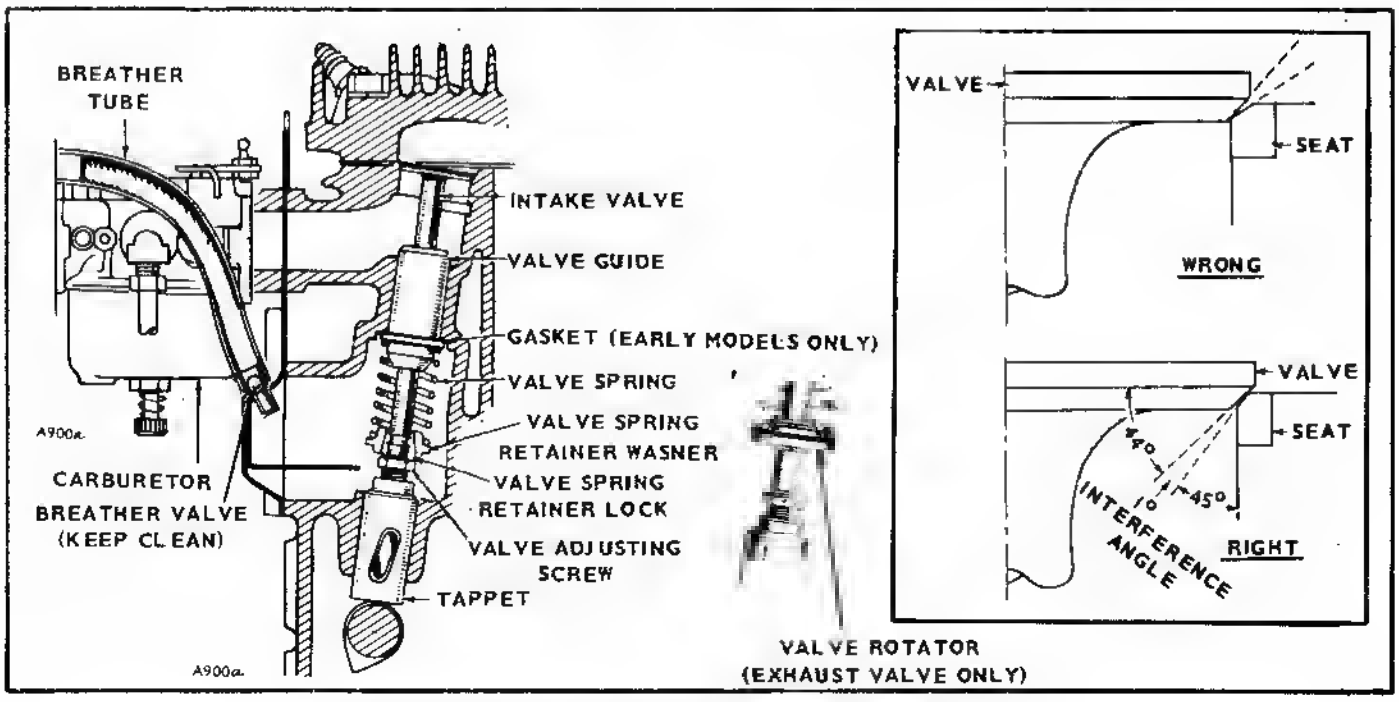


FIGURE 9. VALVE SYSTEM AND VALVE GRINDING ANGLES

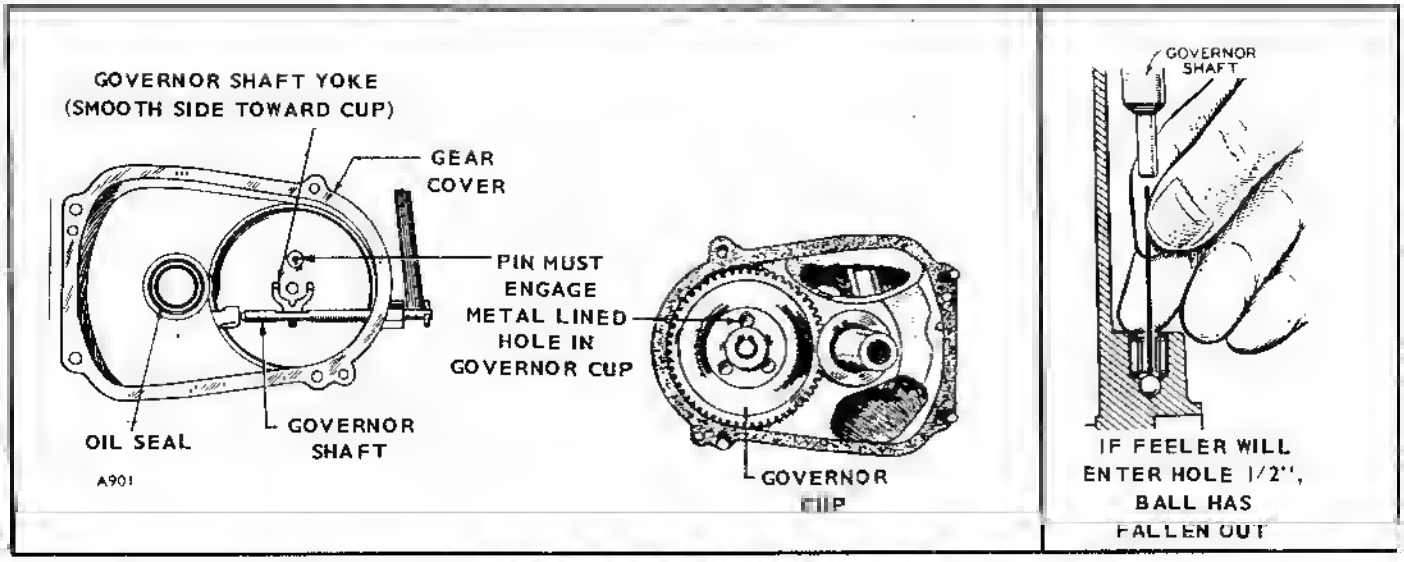


FIGURE 10. GEAR COVER ASSEMBLY

Remove all grinding dust from engine parts and place each valve in its proper location. Check each valve for a tight seat, using an air pressure type testing tool. If such a tool is not available, make pencil marks at intervals across the valve face and observe if the marks rub off uniformly when the valve is rotated part of turn against the seat.

Lightly oil the valve stems and assemble all parts removed. Adjust the valve tappet clearance.

TAPPET ADJUSTMENT

Tappet clearance may be easily checked after first removing the valve compartment cover and the blower housing. Crank the engine over by hand until the intake valve (the one nearest the carburetor) opens and closes. Continue turning the flywheel slowly until the mark on the flywheel is in alignment with the TC mark on the gear cover. The correct tappet clearance for both the intake and exhaust valves appears in the Table of Clearance. Tappets are fitted with self locking adjusting screws. Use a 7/16" wrench for the screw, and a 9/16" wrench for the tappet when making any adjustment.

GEAR COVER

When removing the gear cover, it is not necessary to remove the magneto assembly from the cover. Just disconnect the spark plug lead at the spark plug, and the stop wire.

When installing the gear cover, make sure the pin in the gear cover engages in the metal-lined hole of the governor cup. Turn the governor cup so that hole is in an upward position where it corresponds to the 12 o'clock position on the face of a clock. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Be careful not to damage the gear cover oil seal. See Figure 10.

GOVERNOR CUP

The governor cup may be removed from the cam gear and shaft after first removing the small lock ring from the camshaft center pin. Catch the governor flyballs as the cup assembly is removed. Both 3600 rpm and 3000 rpm 50 cycle units use only five flyballs, while other models use ten flyballs in the governor cup. See Figure 11.

If a new governor cup is being installed, the distance from the small lock ring on the center pin to the face of the governor cup must be exactly 7/32" when the cup is pressed back against the flyballs as far as possible. If the distance is too small, carefully dress the face of the cup as required, being sure to remove any burr from the inside of the cup bore. If the distance is more than 7/32", carefully press the pin in the required amount. Do not damage the pin, as it is difficult to replace it in the field. Replacement of governor flyballs is easier if the plant is tipped backward with the timing gears upward. Be sure that all flyballs are replaced and evenly spaced.

PRESSURE LUBRICATION

All models are not pressure lubricated. Pressure-lubricated plants have a gear type oil pump, oil intake cup and non-adjustable relief valve. If the oil pump fails, install a

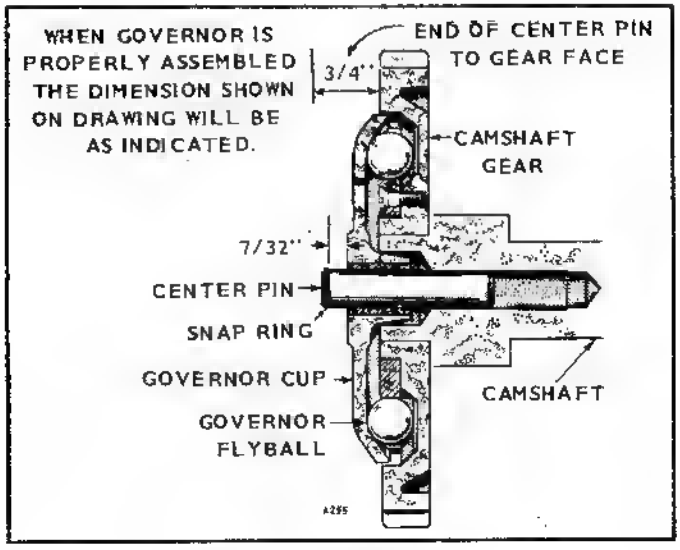


FIGURE 11. GOVERNOR CUP

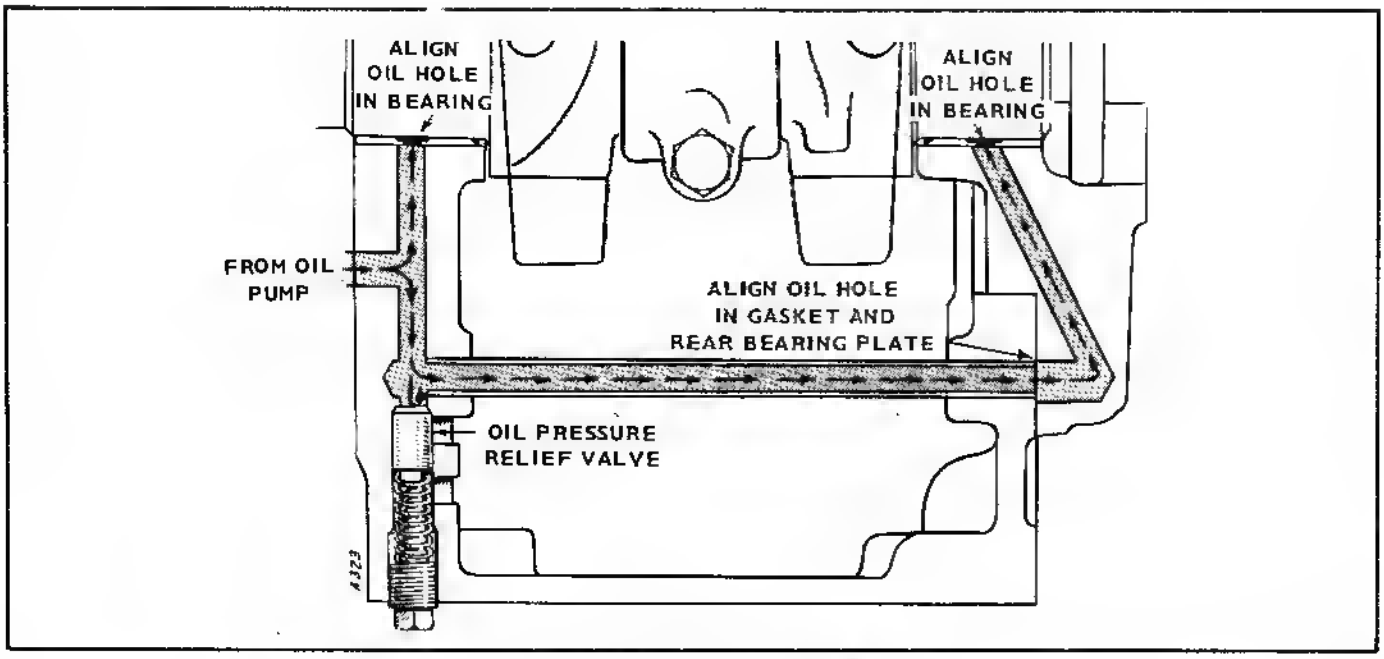


FIGURE 12. PRESSURE LUBRICATION SYSTEM

complete new pump. The relief valve can be removed for cleaning. The internal oil line, if accidentally damaged, is replaceable. Install the intake pipe and cup tightly and at the correct angle to have the cup parallel to the oil base. BE SURE THE PUMP IS PRIMED WITH OIL. Figure 12 shows the pressure lubrication system.

TIMING GEARS

If replacement of either the crankshaft gear or the camshaft gear becomes necessary, install both gears new, never one only. Use a gear puller to remove the crankshaft gear.

The camshaft gear is pressed on and keyed to the camshaft. The camshaft and gear must be removed as an assembly, after first removing the crankshaft gear lock ring and washer. Before removing the camshaft and gear assembly, remove the cylinder head, valve assemblies, fuel pump, tappets and the anti-flicker breaker plunger (where used). After removing the governor cup assembly from the gear, the camshaft may be pressed out of the gear by use of a hollow tool or pipe which will fit over the camshaft center pin. Do not press on the center pin or damage it in any way. The governor ball spacer is a press fit to the camshaft gear. Figure 13 shows camshaft removal.

shaft gear.

When pressing a camshaft gear onto the camshaft, be sure the gear is started straight and that the key is properly in place. Install the governor cup assembly before installing the camshaft and gear in the engine.

Note that each timing gear is stamped with "O" mark near the edge. The gear teeth must mesh so that these marks exactly coincide when the gears are installed in the engine. Be sure, when installing the camshaft gear and shaft assembly, that the thrust washer is properly in place behind the camshaft gear. Replace the retaining washer and lock ring to the crankshaft. See Figure 13.

CYLINDER

The cylinder wears very little in normal service. If through improper lubrication or accident, the cylinder wall should become scored or worn badly, the cylinder may be rebored

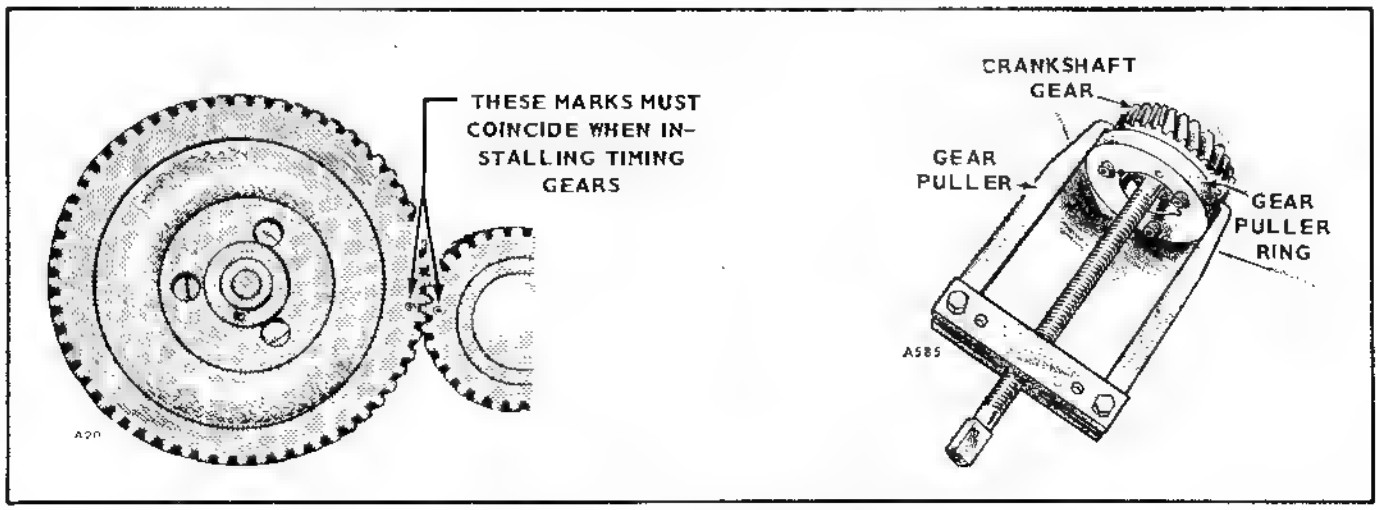


FIGURE 13. TIMING MARKS AND GEAR PULLER

and honed to accommodate a new piston and rings of one of the available oversizes. Pistons and rings are available in .010", .020", .030" and .040" oversizes. Some engines were fitted at the factory with a .005" oversize piston and are so indicated by a letter "E" following the engine serial number stamped on the side of the crankcase and on the nameplate. If the cylinder is not being reconditioned, but new piston rings are being installed, remove any ridge which may have become formed at the top of piston ring travel in the cylinder bore. If the cylinder is excessively glazed, it should be honed with a 180- to 280-grit stone. After honing, clean very thoroughly with SAE 10 oil and a clean cloth. Repeat this cleaning at least three times, until a clean cloth shows no discoloration. Do not use gasoline or kerosene or commercial-type cleaners to remove honing abrasive; they will not do the job. Use standard size rings on a .005" oversize piston.

Oil piston and rings well with SAE 30 oil when reassembling engine. This is important.

PISTON AND RINGS

The piston and connecting rod assembly are removed through the top of the cylinder. The piston is fitted with two compression rings and one oil control ring. The piston ring grooves should be cleaned of any carbon deposits, and the oil return holes in the lower groove must be open. Before installing new rings on the piston, check the ring gap by placing each ring squarely in the cylinder at a position corresponding to the bottom of its travel (Figure 14). The gap between the ends of the ring should be as given in the Table of Clearances. Rings which are slightly oversize may be filed as necessary to obtain the correct gap, but do not use rings which require too much filing. Standard size rings may be used on a .005" oversize piston. .010", .020", .030", and .040" oversize rings are to be used on .010", .020", .030", and .040" oversize pistons, respectively. Rings of the tapered type are usually marked "TOP" on one side, or identified in some other manner, and the ring must be installed with this mark toward the closed end of the piston. Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. The bottom piston ring groove should be fitted with an oil control ring and the two upper grooves fitted with compression rings.

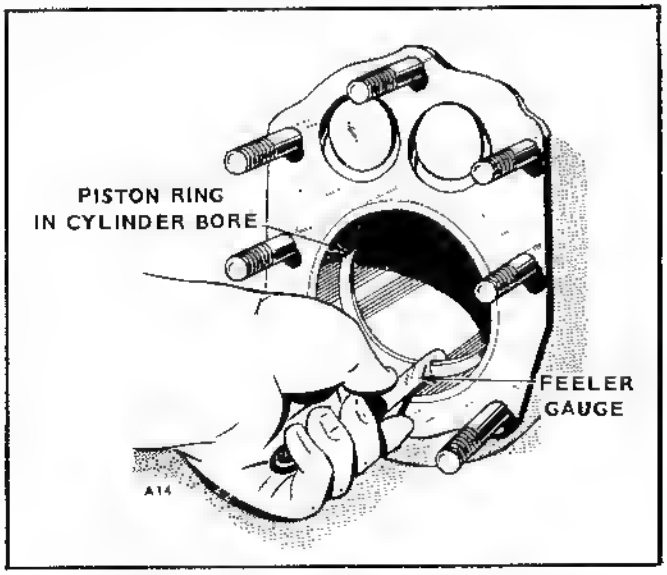


FIGURE 14. CHECKING PISTON RING GAP

The piston is fitted with a full floating piston pin. The pin is kept in place by two lock rings in the piston, one at each side. Be sure these lock rings are properly in place before installing the piston and connecting rod in the engine. Correct piston to cylinder clearance appears in the Table of Clearance.

CONNECTING ROD

Mark the connecting rod before removing it to assure proper re-assembly. Note that the oil dipper is installed so as to splash oil towards the camshaft side of the engine (splash lubrication units only).

Connecting Rods are available in standard size or 0.010", 0.020", and 0.030" undersize.

The connecting rod bearing clearance to the crankshaft journal may be reduced as necessary by carefully dressing the cap on a sheet of abrasive cloth (#320 grit or finer) placed flat on a surface plate or piece of plate glass (Figure 15).

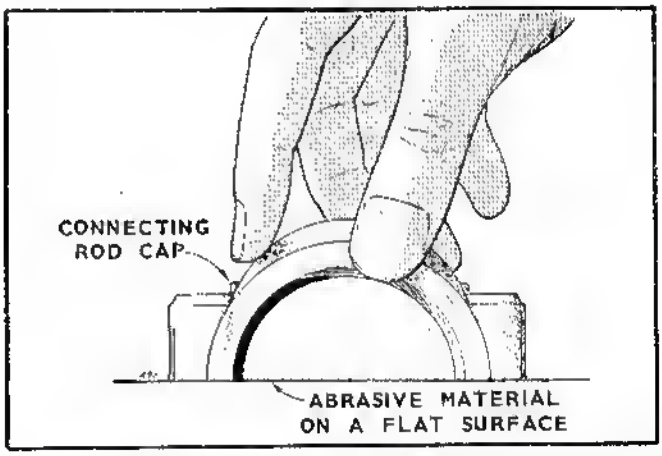


FIGURE 15. REDUCING ROD BEARING CLEARANCE

The connecting rod and piston assembly must be properly aligned before assembly to the engine. Aligning should be done on an accurate aligning gauge by a competent operator. Misalignment may cause rapid wear of piston, pin, cylinder and connecting rod.

Be sure the connecting rod oil dipper is properly installed, as it is vital to proper lubrication (splash lubrication units only).

MAIN BEARINGS

Crankshaft main bearings are precision type and are available in standard size, 0.002", 0.010", 0.020", and 0.030" undersize. Precision type bearings DO NOT require line reaming.

Use a press or a suitable drive plug to remove bearings. Have the cylinder block supported to avoid distortion. Be careful not to damage the bearing bore, especially if a punch tool is used.

Warm the bearing plate and cylinder block slightly with hot water or by placing in an oven heated to 200°F.

CAUTION In an emergency, a blowtorch may be used, but apply only a little heat.

Align the oil hole in the bearing and the oil passage hole in the bearing bore (Fig. 16). On splash-lubricated units, the oil hole will be upward. On pressure-lubricated units the oil hole will be opposite from the camshaft. Install the cold precision bearing so that the inside end of the main bearing is 1/16" to 3/32" back from the inside end of the bore to allow clearance for the machined radius of the crankshaft.

Set crankshaft end play (Figure 17) according to the Table of Clearances by using the correct thickness of gaskets between the rear bearing plate and the cylinder block. Use a feeler gauge to check the clearance. These gaskets must not block the oil passage on pressure lubricated units.

NOTE: *Before mounting generator to engine, tighten the rear bearing plate nuts. After securing generator to the engine, strike the flywheel screw sharply to readjust crankshaft forward end play. This is necessary to prevent excessive front bearing wear.*

CAMSHAFT BEARINGS

Camshaft bearings are precision type and do not require line reaming. Press the front camshaft bearing in flush with the bottom of the counterbore which receives the expansion plug.

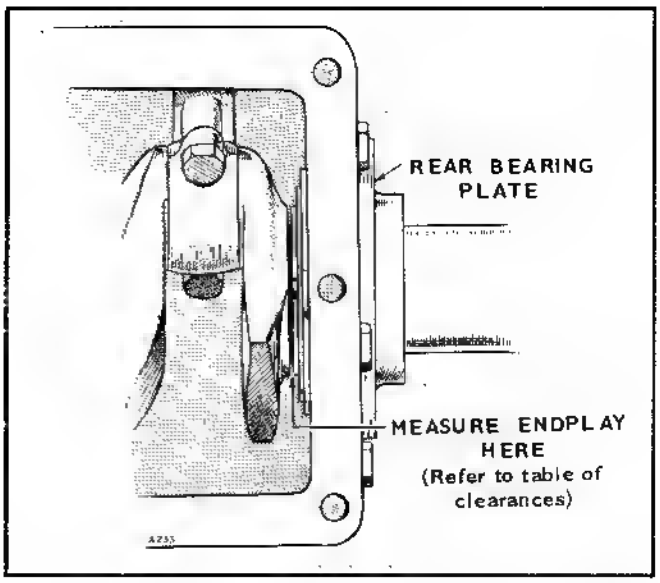


FIGURE 17. CRANKSHAFT ENDPLAY

VALVE COMPARTMENT OIL DRAIN

A drain hole from the valve compartment enters the crankcase. This hole must be unobstructed to provide for proper drainage of oil from the valve compartment.

OIL SEALS

When replacing either crankshaft oil seal (Figure 18), be sure the open side faces toward the inside of the engine. Use care not to turn back the edge of the oil seal or damage it in any way. The rear bearing plate must be removed to replace the rear oil seal. Remove the gear cover to replace the front oil seal. Seal expanding and driving tools are available through the dealer.

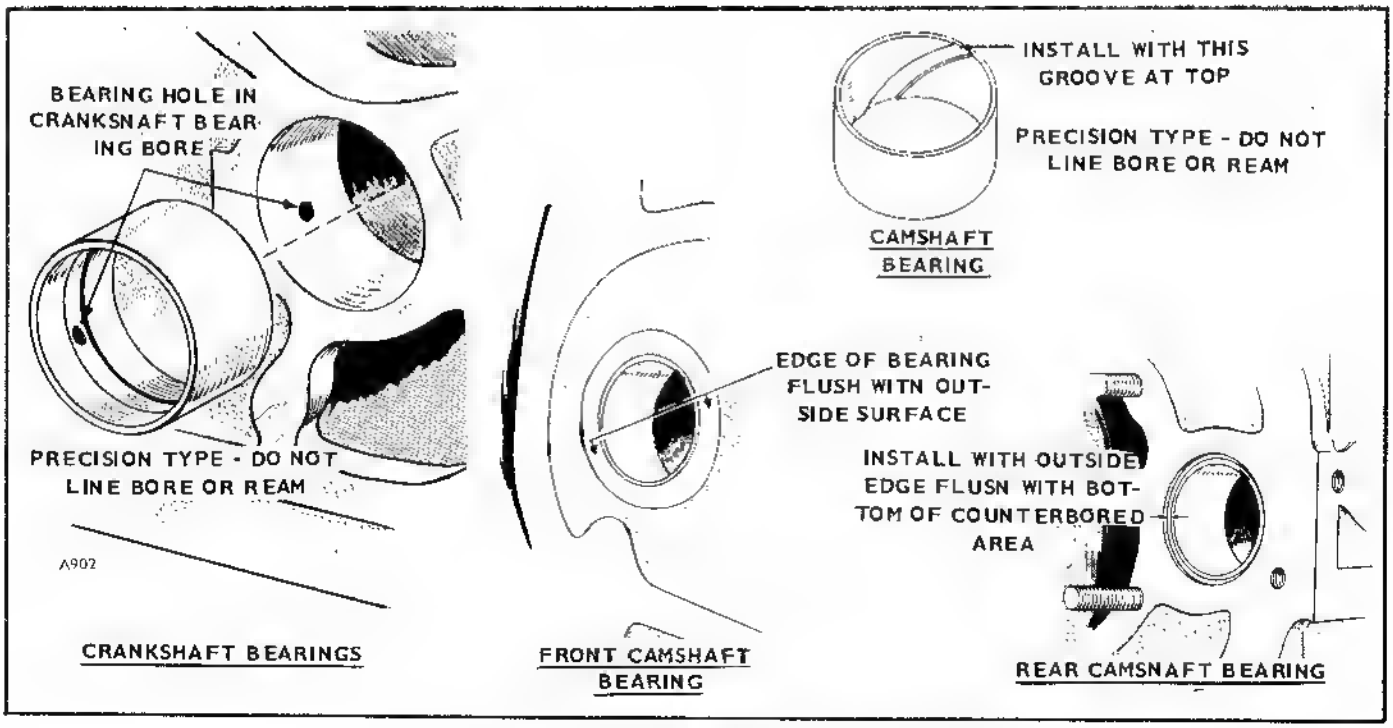


FIGURE 16. CAMSHAFT AND CRANKSHAFT BEARINGS

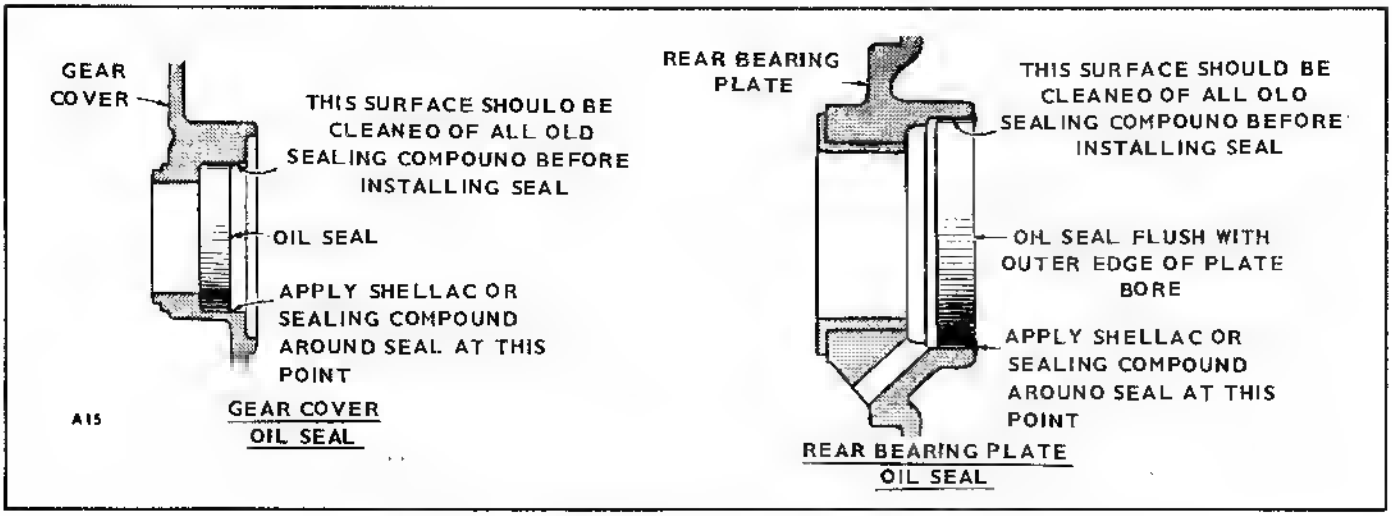


FIGURE 18. GEAR COVER AND REAR BEARING PLATE OIL SEALS

GENERATOR MAINTENANCE AND REPAIR

GENERAL

Two types of generator construction are used in this series of plants. 3600-rpm 60-cycle and 3000-rpm 50-cycle plants have a 2-pole generator. All other plants have a 4-pole generator and differ according to the model.

BRUSH REPLACEMENT

Install new commutator brushes Manual units Prior to Spec J and other rectangular brushes when the old ones are worn to 5/8" or less in length. The cylindrical or nearly square (1/4" x 3/8") type collector ring brush with spring attached may be used until worn to 5/16" in length. It is not necessary to remove the brush rig to install new brushes. Remove the end cover to expose the brush rig. Brushes and leads are then easily accessible. New brushes are shaped to fit and seldom need sanding to seat properly. Always use the correct brush as listed in the parts list. Never substitute a brush which may appear to be the same, but may have different electrical characteristics. Be sure to tighten the brush lead terminal nuts. If some brush sparking occurs after replacing brushes, run the plant at a light load until the brushes wear to a good seat.

BRUSH RIG POSITION

The position of the brush rig is important. The correct setting results in the least sparking at the commutator brushes (manual units prior to Spec J) at average load operation.

On manual models beginning with Spec J, brush rig position is determined and permanently fixed at the factory.

Special models may have a brush rig of the adjustable design, where the neutral position is identified by a "witness" mark at the point of mounting. As long as the original brush rig and armature are continued in service, these reference marks must be observed. If a new brush rig or armature is installed, the original atignment marks may have to be disregarded in order to find the proper neutral position.

COMMUTATOR (Manual & Portable models prior to Spec. J-only)

Commutator and collector rings on AC plants, acquire a glossy brown finish in normal operation. Do not attempt to maintain a bright newly machined appearing surface. Ordinary cleaning with a dry, lint free cloth is usually sufficient. Very fine sandpaper (#00) may be used to remove slight roughness. Use only light pressure on the sandpaper, while the plant is operating. Do not use emery or carborundum paper or cloth. Clean out all carbon dust from the generator.

After long service, the surface of the commutator may become worn down to the level of the mica insulation between the commutator bars. This condition will lead to noisy brush action, excessive brush sparking and wear and pitting of the commutator bars. Undercut the mica between the bars to 1/32" below the surface of the bars. If it is not convenient to take the armature to an electrical shop, the operation may be done with a tool fashioned from a hack saw blade. Grind the blade to a thickness equal to the mica between the bars. Do not scratch the surface of any bar. Use sandpaper to remove any burrs left along the edges of the bars. See that spaces between the bars are perfectly clean before assembling the generator.

If the commutator becomes damaged, or wears unevenly so that it is grooved or out of round, turn it smooth in a lathe. After turning, the mica must be undercut as described above.

GENERATOR DISASSEMBLY

To disassemble the generator, first remove the end cover. Lift each brush high in its guide, so that the brush is held by spring pressure against its side. It is not necessary to remove the brush rig from its support. Tag leads which are disconnected, to assure correct replacement. Mark the position of other parts by scratching them to aid correct replacement. After removing the two frame stud nuts, the brush rig and frame may be removed as a unit, the armature bearing remaining on the armature.

To remove the armature, loosen the armature through-stud just enough to avoid damaging the threads. While pulling outward on the armature, strike the nut a sharp endwise blow with a heavy, soft-faced hammer to loosen the armature. The armature has an external taper which fits into the internal taper of the engine crankshaft. When the armature is loose, remove the stud nut and slide the armature carefully off the through-stud.

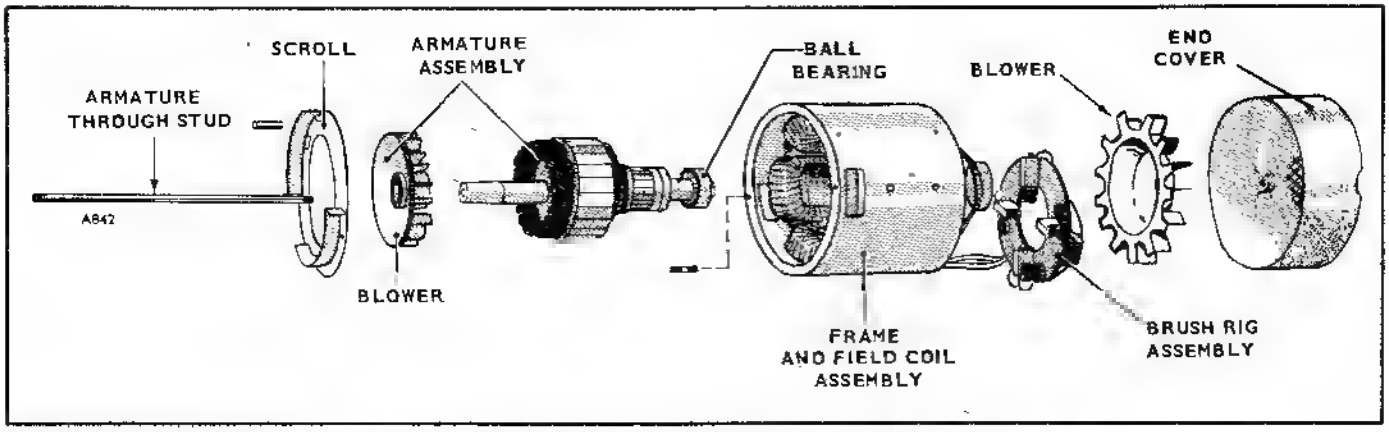


FIGURE 19. GENERATOR DISASSEMBLY (BEFORE SPEC J)

FIELD WINDINGS

A ground or open circuit in the field coils may be determined by using a continuity type test lamp. Disconnect (and tag) all field leads. Refer to the proper wiring diagram. Test the field winding for an open circuit by placing one test prod on each of the two terminal ends of the winding. If the test lamp does not light, the field winding is open. If the open circuit can be located in one of the external leads, the break can be easily repaired. An internal break usually requires replacement of the coil set. A grounded condition can be determined by placing one test prod on a terminal end of the winding and the other test prod on a bare metal part of the generator frame. If the test lamp lights, a ground is indicated. Find the point where the ground occurs and repair as necessary.

An internal short circuit is best located by the use of a sensitive ohmmeter. By comparing the resistance of each individual coil winding, a short circuited coil is indicated by a lower resistance reading. Replace the entire coil set assembly if a short circuit is indicated.

ARMATURE

Armatures may be tested for a ground by placing one test prod of a continuity type test lamp on the center shaft and the other test prod first on the commutator, then on one of the collector rings. If the test lamp lights, the armature is grounded. Place a test prod on each of the two collector rings. If the test lamp does not light, the ac winding is open circuited. The use of an armature growler is required to test the dc winding for an open circuit, and to test for a short circuit. Follow the directions of the growler manufacturer.

RECTIFIERS (Manual and Portable Plants beginning with Spec. J).

Test each rectifier believed to be defective by isolating it and measuring the resistance first in one direction, then in the other. If the rectifier is operating properly, one reading will be much higher than the other (at least 10 times higher). If a test lamp is used, first touch the tester probes together and observe the brightness of the bulb. Then touch them across the rectifier. If the bulb lights brightly or not at all, the rectifier is defective. If it lights dimly, this indicates that the rectifier is passing current in only one direction and is functioning properly. Replace any rectifier found defective. This procedure is shown in Figure 20.

GENERATOR ASSEMBLY

1. Clean and inspect all mating surfaces. Surfaces should be free of nicks and dirt.
2. Coat mating area between the generator shaft and the engine crankshaft with a thin film of lubricating oil, Molycoat or equal.
3. Assemble the armature through stud to the engine crankshaft with required torque.
4. Check to see that the key is in the crankshaft.
5. Slide armature over the through stud and onto the crankshaft, being careful not to let the weight of the armature rest on the through stud.
6. Install baffle ring, when used.
7. Assemble generator through studs to the adapter with required torque.

CAUTION DO NOT tighten the armature or rotor through stud before mounting the frame and bearing support. If this procedure is not followed, misalignment may occur, shortening the life of the rear main and outboard bearings. Also, cranking torque requirements could be doubled, resulting in damage to the commutator and DC brushes.

8. Install the frame and bearing support. Tighten frame to required torque.
9. NOW torque down the armature through-stud nut. Because you have tightened the frame and bearing support before tightening the armature, you have the armature and frame in alignment.
10. Tap the bearing support in the horizontal and vertical plane with a lead hammer to relieve stresses on the components and then recheck the torque.
11. Reconnect the decompression solenoid and other leads to the engine.
12. Reinstall the battery cables.
13. Align the brush rig.

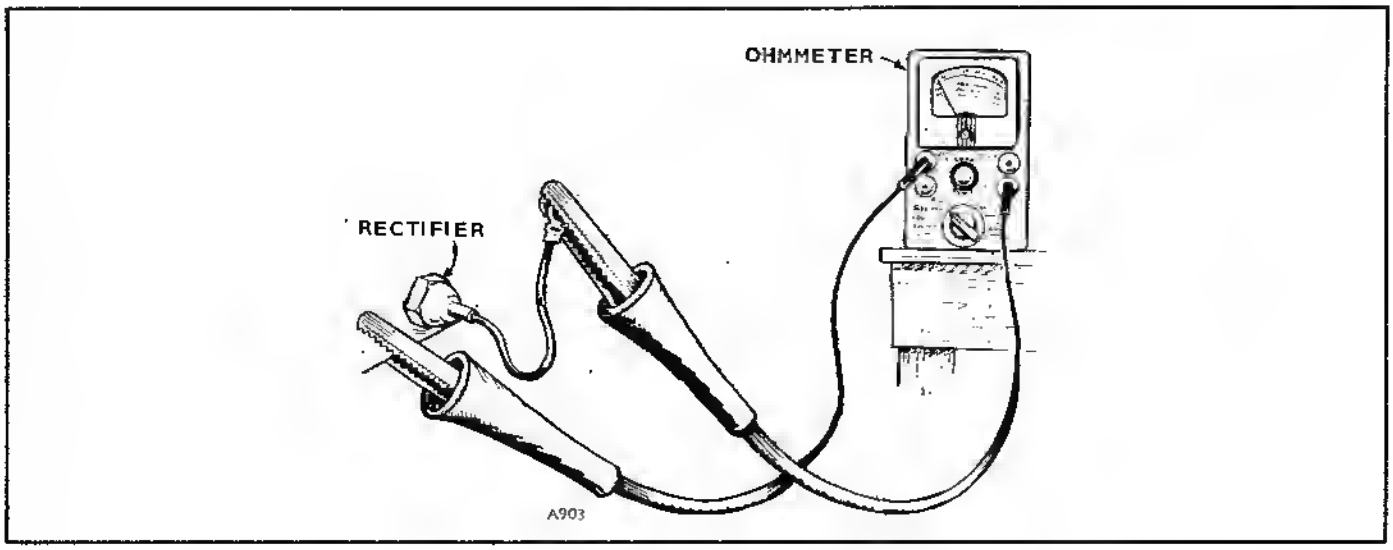


FIGURE 20. CHECKING RECTIFIERS

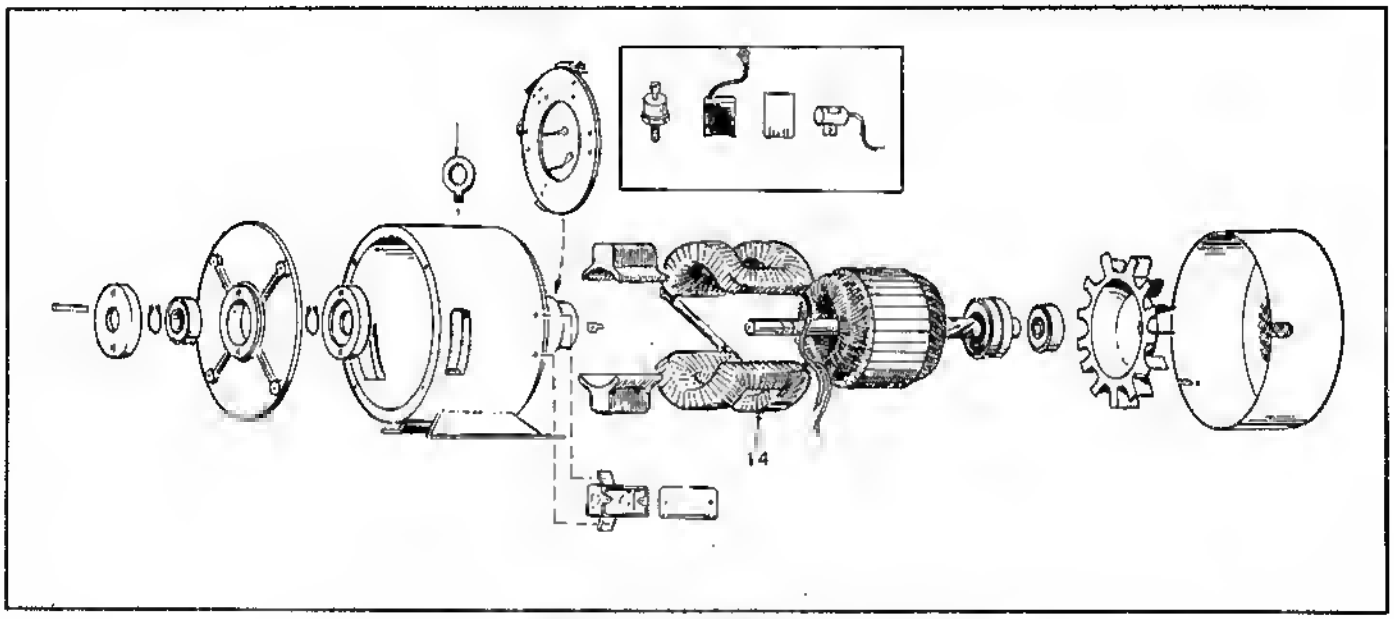


FIGURE 21. GENERATOR ASSEMBLY (SPEC J AND LATER)

CONTROL BOX EQUIPMENT

Always disconnect the battery from the plant whenever servicing any control box equipment. Keep all connections tight and clean, and inspect leads occasionally for worn insulation. If any of the control box equipment does not function properly, replace the defective part with a corresponding new unit. It is seldom practicable to repair relays, switches, etc.

OIODE TESTING

Beginning with Spec M on battery charging models, the reverse current relay has been eliminated and replaced with a power diode and heat sink.

An "open" diode will prevent current from reaching the battery being charged. If this occurs, use the following procedure for diode testing.

Isolate the diode from the circuit. Connect an ohmmeter across the diode leads .and observe the meter reading. Reverse the ohmmeter connections and compare the meter readings. If one reading is considerably higher than the other, the diode may be considered satisfactory. However, if both readings are low, or if both indicate an "open" circuit, replace the diode without question. If the readings appear to be marginal, replacement of the diode is strongly suggested. Be sure any replacement is made with an identical part.

RECOIL STARTER

STARTER INSTALLATION

Follow each step in proper sequence. Refer to Fig. 22 for part reference numbers.

1. Remove the flywheel screw. Leave the existing rope sheave in place. The washers and screw are also re-used. The sheave provides easier emergency cranking than the starter cup.

2. Secure cup #2 by placing lock washer #26 and flat washer #24 between cup and cap screw #23. See Figure 22B.

3. Assemble the mounting ring #3 (sometimes called bracket) to the starter (if not already so attached) using the four screws #4, and selecting the correct one of four possible positions to give the desired direction of rope pull.

4. Prior to Spec G only use nuts #22 on the engine housing.

5. Failure to center the starter properly will damage the starter. Incorrect alignment may be caused by distortion of, or shifting of, the blower housing on the engine.

   Place the starter against the engine blower housing and check to see that the centering pin #19 engages the center hole of the cup-and-fly-wheel-mounting capscrew while the starter mounting holes align. (**NOTE**: If the centering pin does not extend a sufficient length to engage the center hole of the capscrew, a pair of pliers can be used to pull the pin out farther.) Use toothed washers and screws #21 to mount the starter securely to the blower housing.

6. Operate the starter to see that the installation is satisfactory. After the starter is mounted on the engine, there should be clearance of approximately 1/8" between cup #2 and rotor face #17. A minimum clearance of 3/32" between capscrew #23 and starter shaft must also be maintained.

7. During operation, the starter friction shoe plates will roughen the cup. This condition is normal.

8. When operating the starter, slowly pull out at least six inches of cord, then give a fast steady pull. By this method, cord breakage is less apt to occur due to a false start and engine backfiring.

STARTER DISASSEMBLY

WARNING: *Improper disassembly may allow rewind spring to release wildly and cause personal injury.*

1. Loss of spring #8 can be avoided by holding washer #7 in position with hand while removing truarc retainer ring #6 with a screw driver. See Figure 22C.

2. Remove the following parts and assembly.

   Large washer #7; Brake Spring #8; Washers #9 and 10; Friction Shoe Assembly - (Including parts #11, 12, 13 and 14); Washers #10 and 9.

3. To prevent spring rotation of rotor (rope sheave) #17, cord can be held as shown in Figure 22D, while removing four screws. Continue to hold rotor and cover as shown and remove mounting ring #3 and middle flange #5. Now the tension of the re-wind spring can be relieved by slowly releasing hold, and allowing spring to unwind.

4. Prevent re-wind spring #18 from escaping from cover (and causing personal injury) by carefully lifting rotor #17 only 1/4" away from the cover and detach inside spring loop from rotor as shown in Figure 22E. (**NOTE**: If spring should escape, it can be replaced in cover easily by coiling in turns.)

5. Clean the starter parts. Gummy grease and dirt may cause sluggish performance.

CORD REPLACEMENT

1. First perform procedure given for starter disassembly.

2. Tie single knot in end of new cord. See Figure 22F.

3. Thread cord through rotor hole and out through rotor cord groove, pulling knot into cavity, then wind rope on rotor. Replace handle, tying a double knot.

4. Perform procedure given for starter assembly.

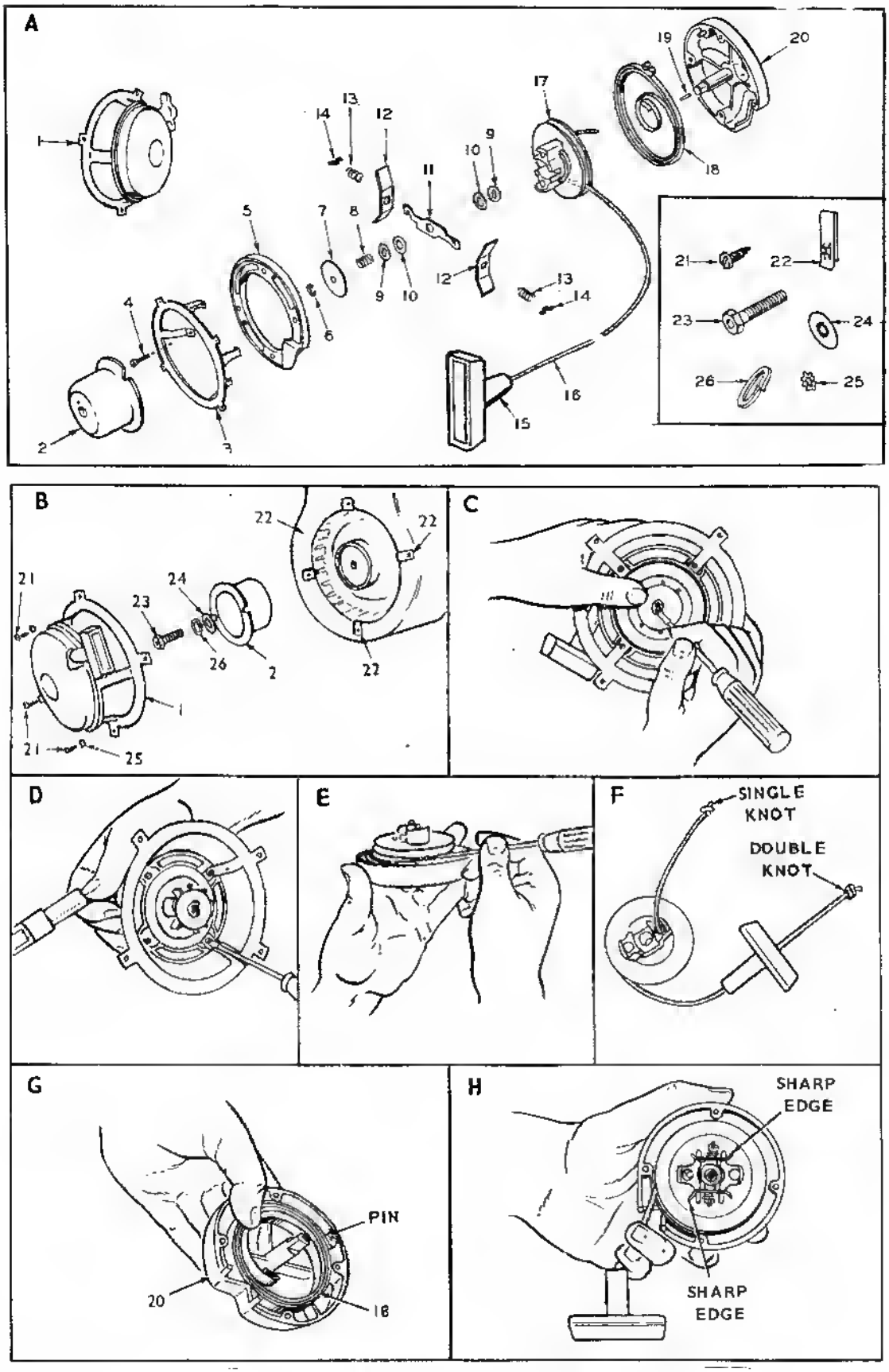


FIGURE 22. SERVICING THE RECOIL STARTER

RE-WIND SPRING REPLACEMENT

1. First perform procedure given for starter disassembly.

2. Starting with the inside loop, remove re-wind spring #18 carefully from cover #20 by pulling out one loop at a time; holding back rest of turns. NOTE: that starting from the outermost coil of the spring, the spring must be wound in crankshaft rotation direction.

3. Spring holders furnished with replacement springs simplify the assembly procedure. Place spring in proper position as shown in Figure 22G, with the outside loop engaged around the pin. Then press spring into cover cavity thus releasing the spring holder.

4. Lubricate the shaft with a film of light grease. Lubricate the rewind spring with a few drops of SAE 20 or SAE 30 oil. Under extremely dusty operating conditions, if performance indicates a dirty condition, then use only powdered lubricating graphite on the spring or do not lubricate it at all. Avoid lubrication of the brake washers.

5. Perform procedure given for starter assembly.

STARTER ASSEMBLY

1. First complete installation of re-wind spring and cord.

2. Place rotor #17 (complete with handle and cord wound in proper direction) into cover #20 and hook the inside loop of spring #18 to rotor with the aid of a screw driver or other slender tool. Prevent the unhooking of the rewind spring from the rotor by keeping a slight tension on the spring until later when the middle flange is installed.

3. Install the following parts and assembly:

   Washers #9 and 10; Friction shoe assembly (See Figure 22H for positions.) (Including parts #11, 12, 13 and 14); Washers #10 and 9; Spring #8; Larger Washer #7; and Truarc retainer ring #6.

4. Wind the cord in the proper direction onto the rotor, then add two additional turns of the rotor and cord for pre-tension. A fatigued spring condition may require more additional turns to attain desired pre-tension of the re-wind spring.

5. With tension held on the cord, place middle flange #5 against cover #20, then install mounting ring #3 in position for desired direction of pull and continue as instructed under starter installation.

TROUBLE SHOOTING

If friction shoe fails to function and engage with the cup, check for failure of brake spring #8, check for lubrication getting onto brake washers #10, and check for proper position of friction shoe sharp edge and friction shoe lever.

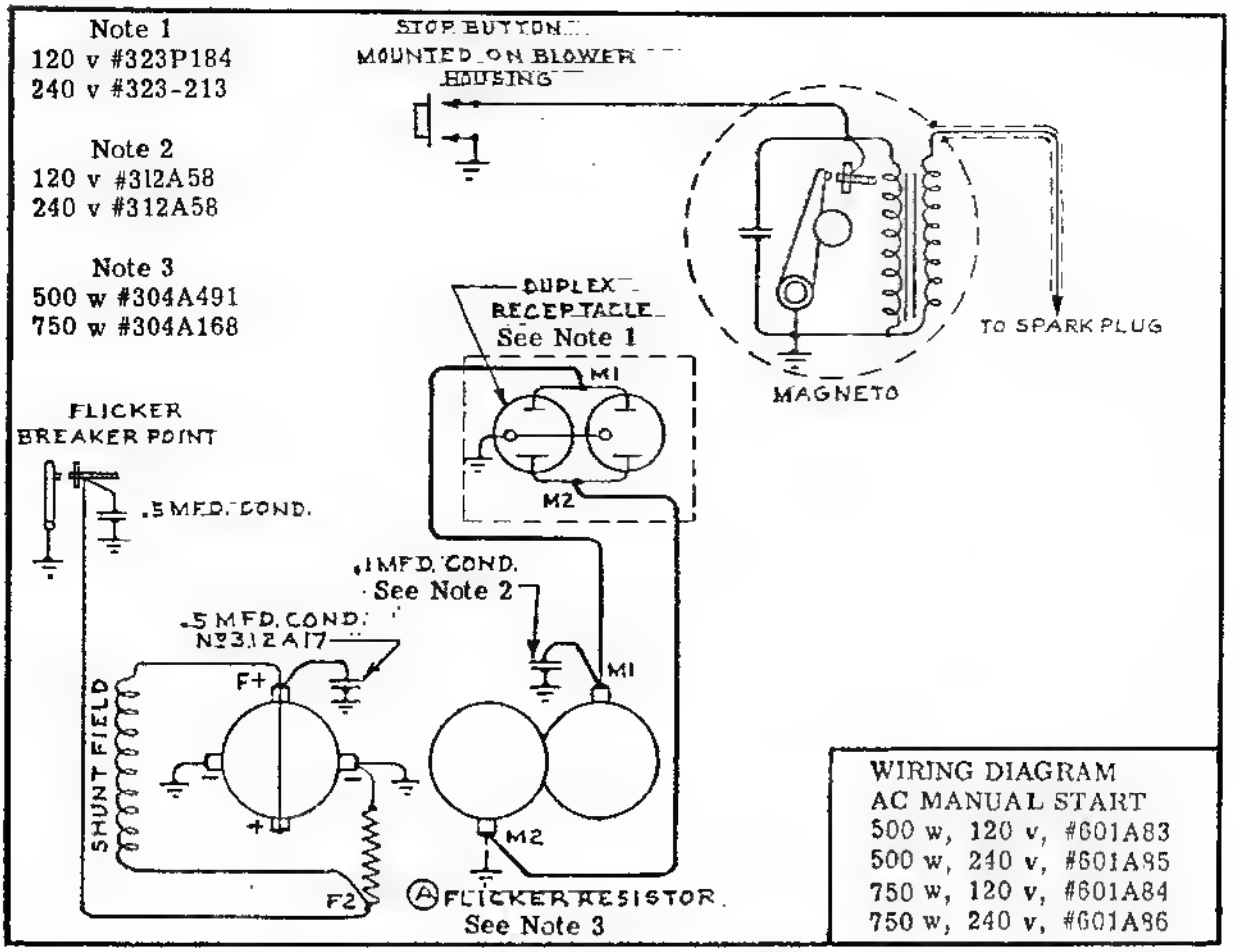
Periodically observe if starter assembly has shifted away from centering with crankshaft.

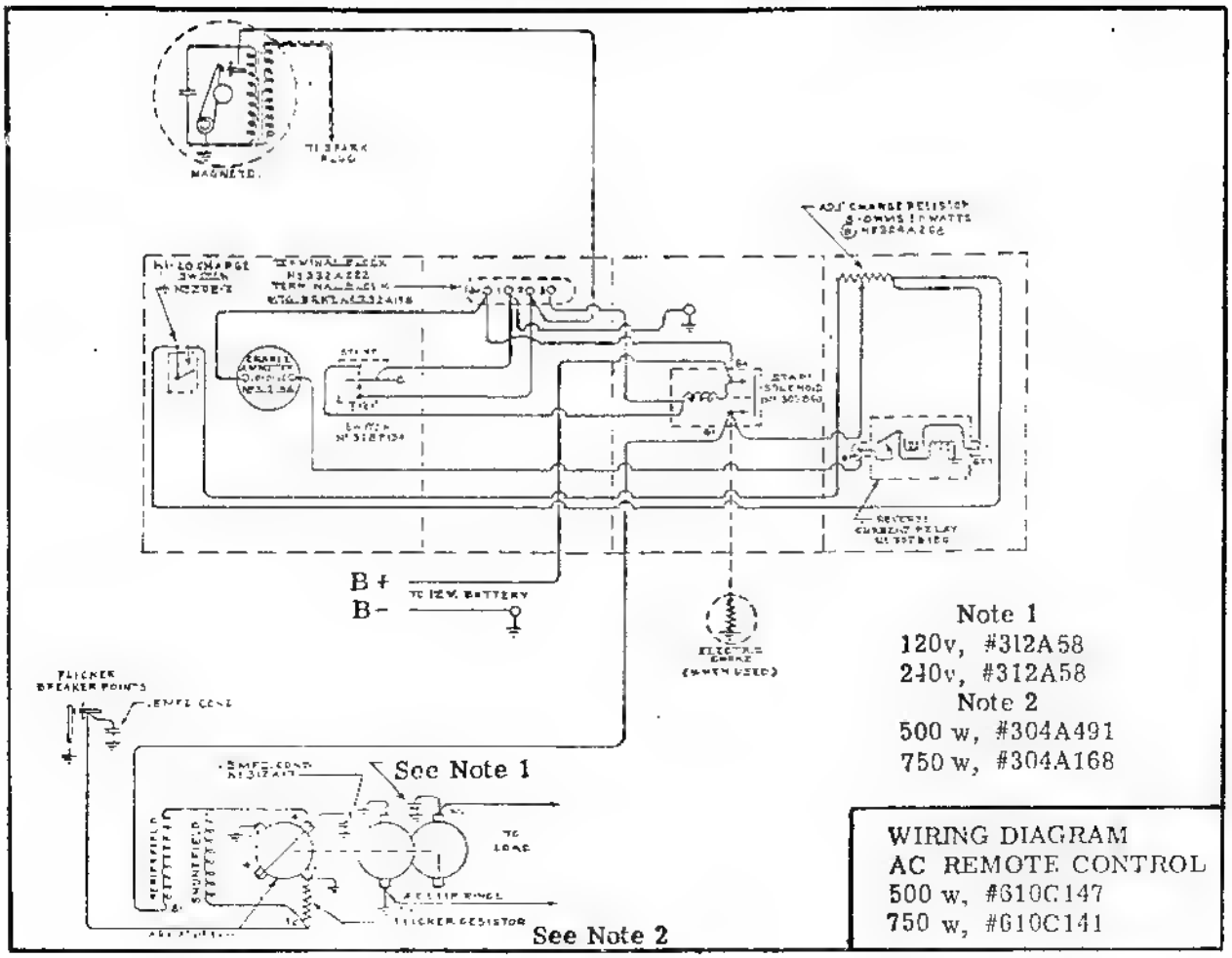
A broken re-wind spring should be replaced with a new one.

The life of a fatigued re-wind spring can be extended by adding turns of the rotor to increase pre-tension and then re-installing the middle flange. Or, try forming new loops and coiling spring inside-out.

WIRING DIAGRAMS

The wiring diagrams in this section are typical and apply only to standard generating plants beginning with Spec L. Wiring diagrams for special models or models prior to Spec L are available on request from the factory, send generator model, spec, and serial numbers with the request.

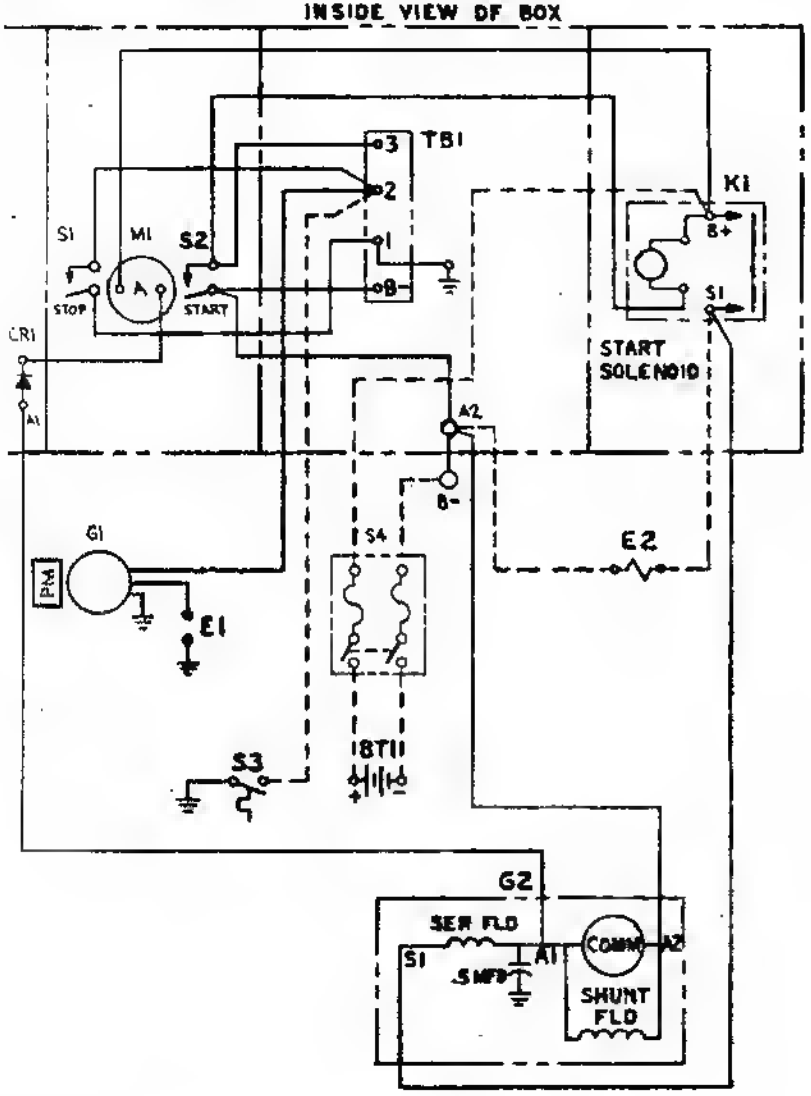

Note 1
120 v #323P184
240 v #323-213
Note 2
120 v #312A58
240 v #312A58
Note 3
500 w #304A491
750 w #304A168
STOP BUTTON MOUNTED ON BLOWER HOUSING
MAGNETO
TO SPARK PLUG
DUPLEX RECEPTACLE See Note 1
M1
M2
FLICKER BREAKER POINT
.5 MFD. COND.
.1 MFD. COND. See Note 2
.5 MFD. COND. N°312A17
F+
F-
SHUNT FIELD
F2
A FLICKER RESISTOR See Note 3
WIRING DIAGRAM
AC MANUAL START
500 w, 120 v, #601A83
500 w, 240 v, #601A85
750 w, 120 v, #601A84
750 w, 240 v, #601A86


B+
B-
FLICKER BREAKER POINTS
See Note 1
See Note 2
Note 1
120v, #312A58
240v, #312A58
Note 2
500 w, #304A491
750 w, #304A168
WIRING DIAGRAM
AC REMOTE CONTROL
500 w, #610C147
750 w, #610C141

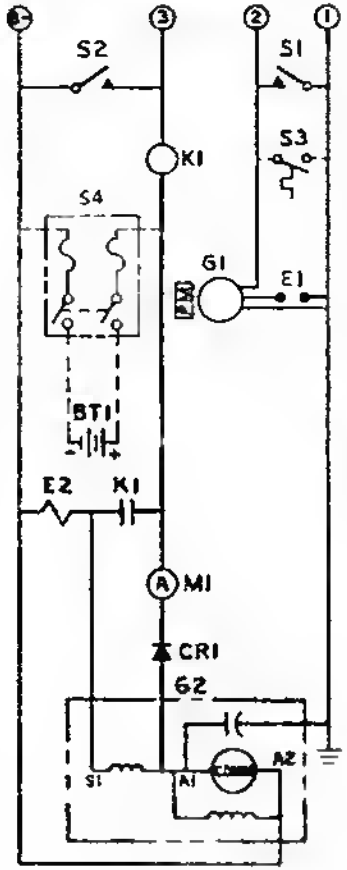
610B335

WIRING DIAGRAM

INSIDE VIEW OF BOX



SCHEMATIC



PARTS LIST

	REF DES.	PART NO.	QTY	DESCRIPTION
*	BT1		1	BATTERY, 24V OR 32V
	CR1	358840	1	DIODE & HEAT SINK ASSY
		8TOP196	4	NUT-INSULATING .88
		809-35	4	SCREW-RHSM #8-32, 3/4 LG
**	E2		1	CHOKE-ELECTRIC
	G1		1	MAGNETO
	G2		1	GENERATOR
	E1		1	SPARK PLUG
	K1	307861	1	RELAY-START SOLENOID
	M1	302A61	1	AMMETER-CHARGE 30-0-30
	S1	308-155	1	SWITCH-STOP
	S2	308-155	1	SWITCH-START
**	S3		1	SWITCH-HIGH TEMP CUTOUT
*	S4		1	SWITCH-FUSED 100A FOR 24V 50A FOR 32V
	TB1	332A222	1	BLOCK-TERMINAL
		332A198	1	BRACKET-TERM BLOCK MTG
		301D341Z	1	CONTROL BOX
		301C1850	1	COVER-CONTROL BOX
		98A1497	1	SILKSCREEN

*FURNISHED BY CUSTOMER
**WHEN USED

610B335	(A)	MODEL NO	
-01	0.7AK-232E/1M	0.7AK-224E/1M	
	32V ELECTRIC	24 V ELECTRIC	

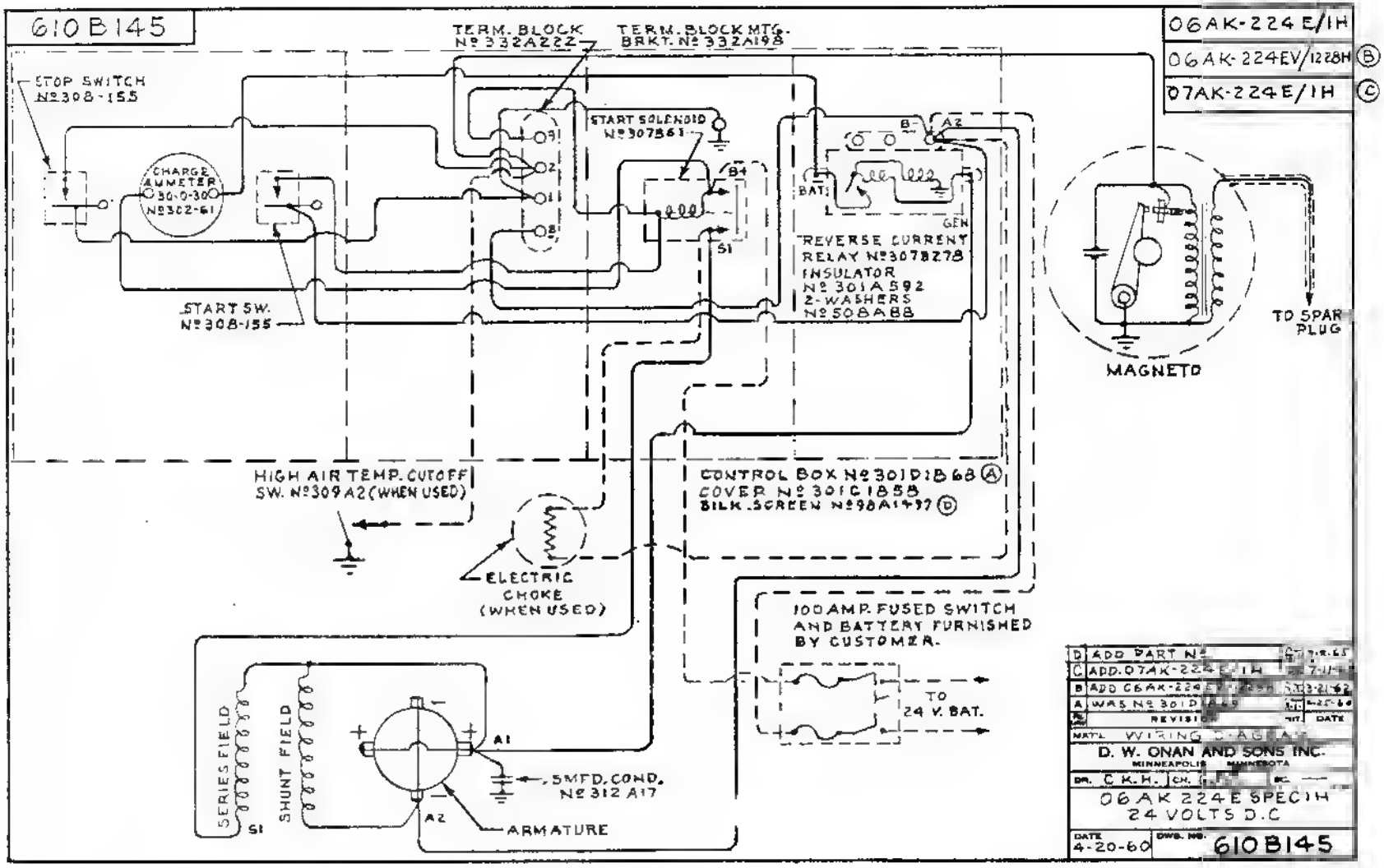
A	WAS 0.7AK-232E & -224E, 1L	G.F.T.	6-17-71
LTR	REVISION	DES	DATE

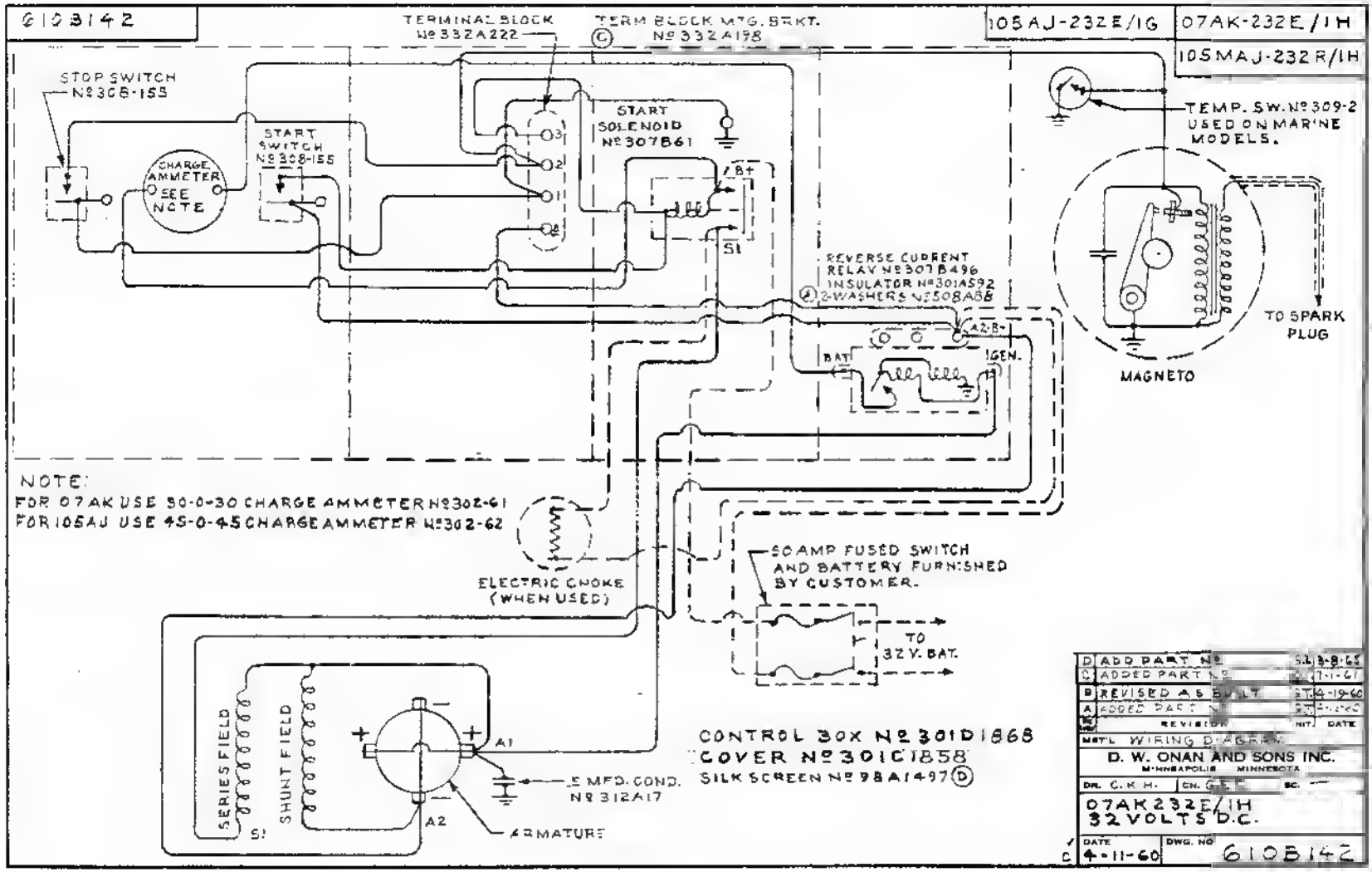
Onan — DIVISION OF STUDEBAKER CORPORATION

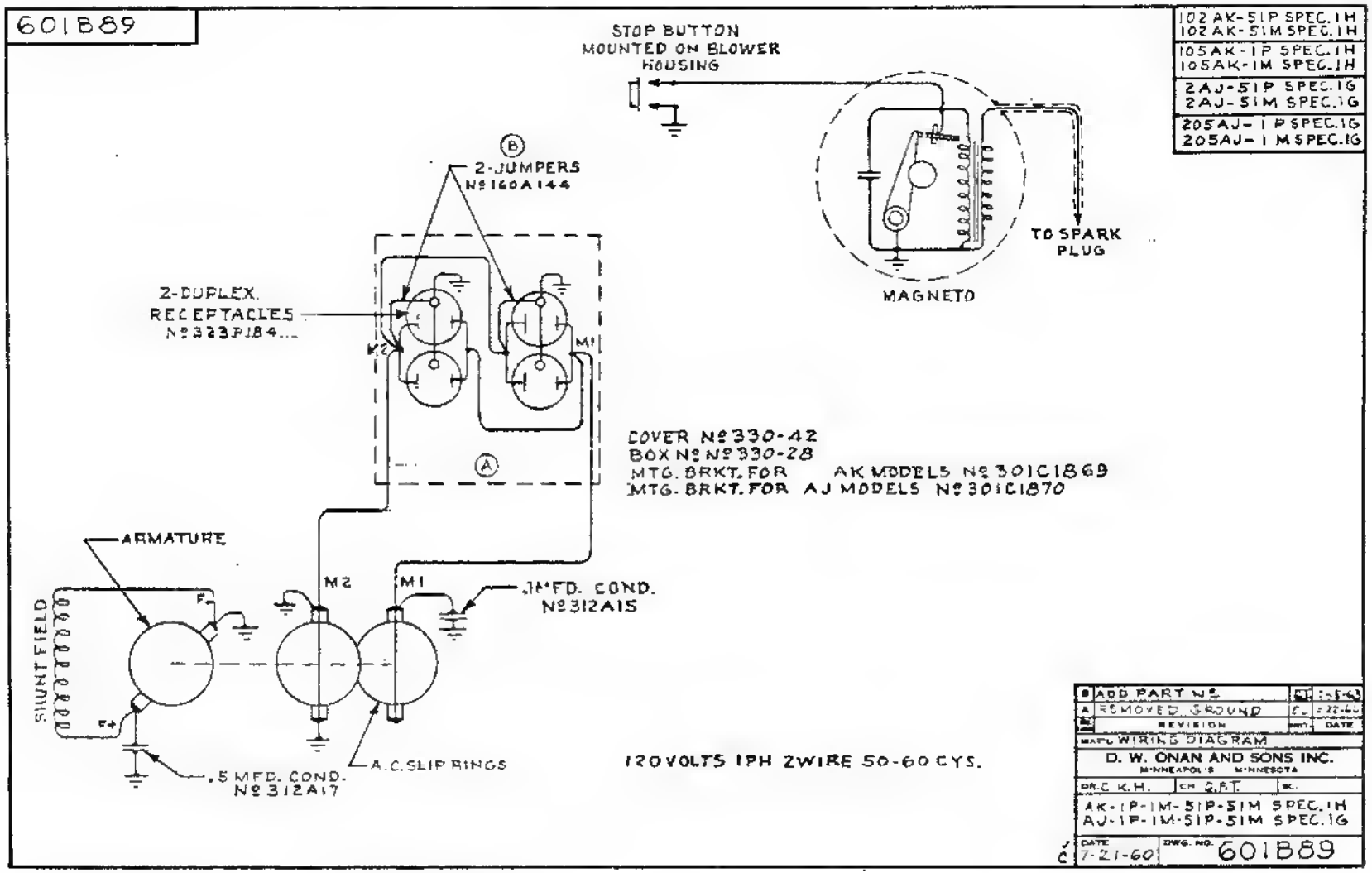
DATE	BY	CHK
4-8-71	JTM	G.F.T.

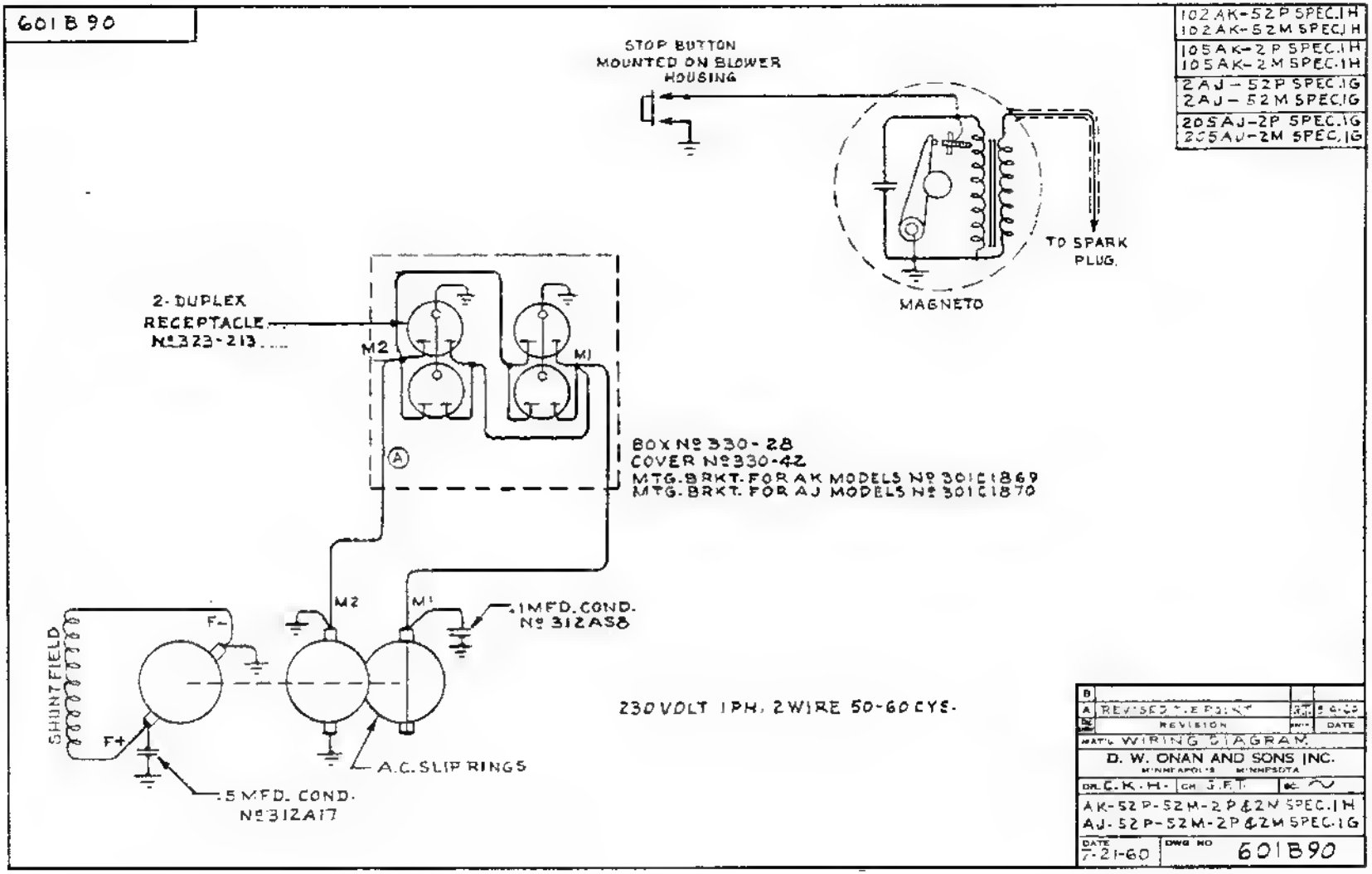
CONTROL-GEN SET (WIRING DIAGRAM)

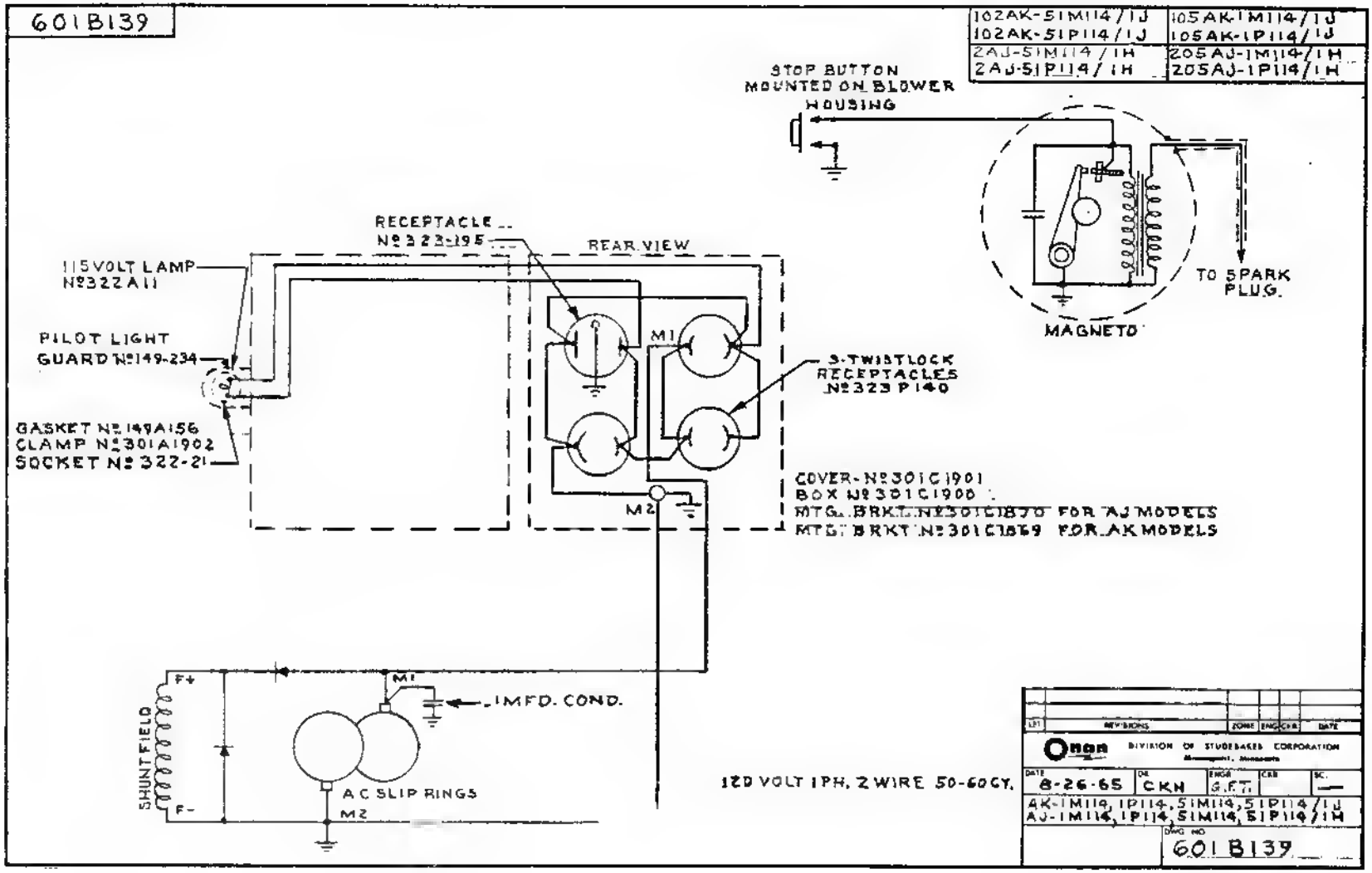
DWG. NO. 610B335


610B145
06AK-224E/1H
06AK-224EV/1228H (B)
07AK-224E/1H (C)
TERM. BLOCK Nº 332A222
TERM. BLOCK MTG. BRKT. Nº 332A198
STOP SWITCH Nº308-155
CHARGE AMMETER 30-0-30 Nº302-61
START SOLENOID Nº307861
START SW. Nº308-155
REVERSE CURRENT RELAY Nº307B278
INSULATOR Nº 301A592
2-WASHERS Nº 508A88
MAGNETO
TO SPARK PLUG
HIGH AIR TEMP. CUTOFF SW. Nº309A2 (WHEN USED)
ELECTRIC CHOKE (WHEN USED)
CONTROL BOX Nº301D1868 (A)
COVER Nº301C1858
SILK SCREEN Nº98A1497 (D)
100 AMP. FUSED SWITCH AND BATTERY FURNISHED BY CUSTOMER.
TO 24 V. BAT.
SERIES FIELD
SHUNT FIELD
S1
A1
A2
.5MFD. COND. Nº312A17
ARMATURE
D ADD PART Nº
C ADD. 07AK-224E/1H
B ADD 06AK-224E
A WAS Nº 301D
REVISION
DATE
MATL WIRING DIAGRAM
D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA
DR. C.K.H. CH.
06AK 224E SPEC 1H
24 VOLTS D.C
DATE 4-20-60
DWG. NO. 610B145


610B142
TERMINAL BLOCK Nº 332A222
TERM BLOCK MTG. BRKT. Nº 332A198
105AJ-232E/1G
07AK-232E/1H
105MAJ-232R/1H
STOP SWITCH Nº 308-155
START SWITCH Nº 308-155
CHARGE AMMETER SEE NOTE
START SOLENOID Nº 307861
S1
REVERSE CURRENT RELAY Nº 307B496
INSULATOR Nº 301A592
2-WASHERS Nº 508A68
A2-B-
BAT
IGEN.
TEMP. SW. Nº 309-2 USED ON MARINE MODELS.
MAGNETO
TO SPARK PLUG
NOTE:
FOR 07AK USE 30-0-30 CHARGE AMMETER Nº 302-61
FOR 105AJ USE 45-0-45 CHARGE AMMETER Nº 302-62
ELECTRIC CHOKE (WHEN USED)
50 AMP FUSED SWITCH AND BATTERY FURNISHED BY CUSTOMER.
TO 32 V. BAT.
SERIES FIELD
SHUNT FIELD
S1
A1
A2
.5 MFD. COND. Nº 312A17
ARMATURE
CONTROL BOX Nº 301D1868
COVER Nº 301C1858
SILK SCREEN Nº 98A1497 D
D ADD PART Nº S.L. 3-8-65
C ADDED PART Nº " 7-11-61
B REVISED AS BUILT " 4-19-60
A ADDED PART Nº " 2-1-60
REVISION INIT. DATE
MST'L WIRING DIAGRAM
D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA
DR. C. K. H. CH. SC.
07AK 232E/1H
32 VOLTS D.C.
DATE 4-11-60
DWG. NO 610B142

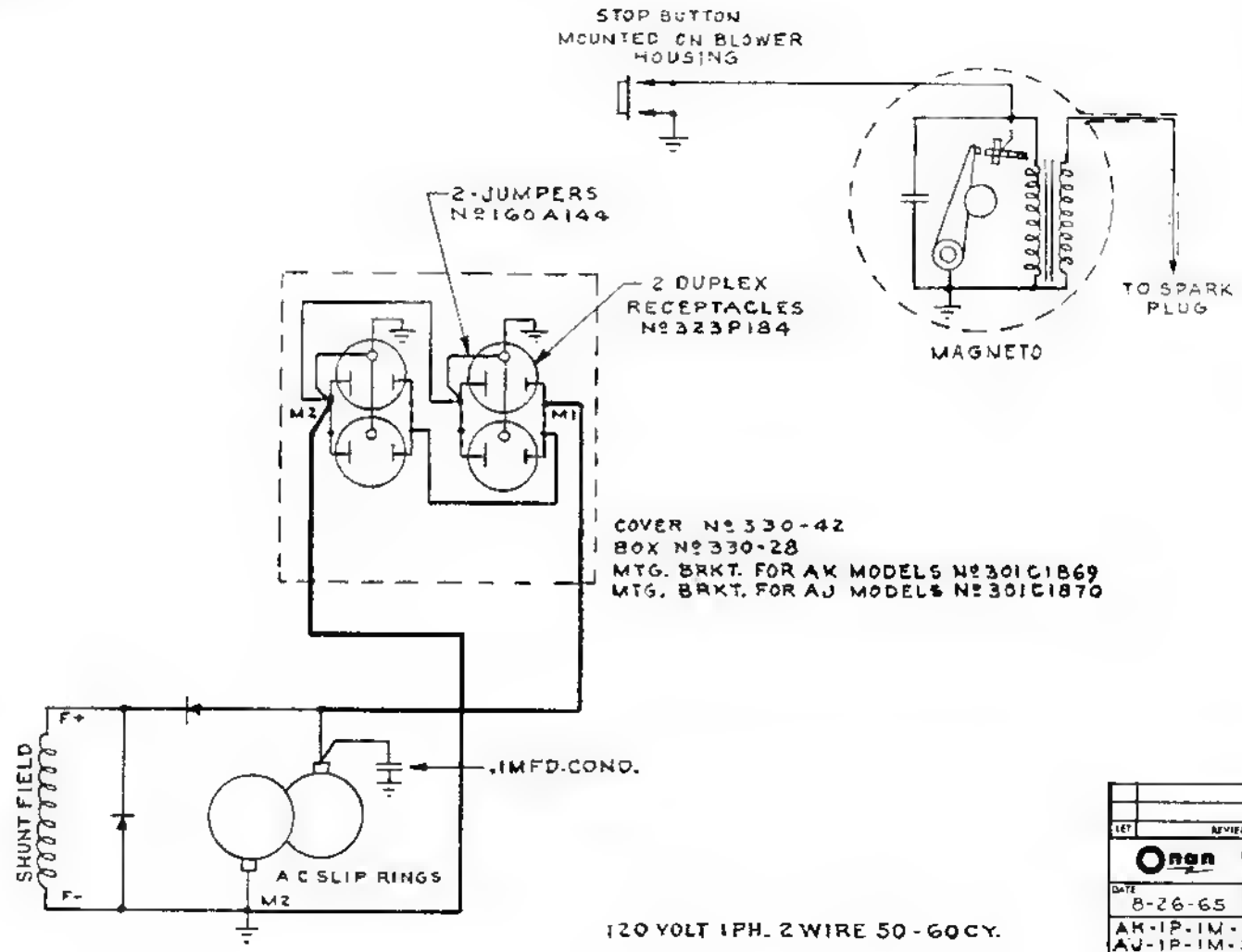

601889
STOP BUTTON
MOUNTED ON BLOWER
HOUSING
102AK-51P SPEC.1H
102AK-51M SPEC.1H
105AK-1P SPEC.1H
105AK-1M SPEC.1H
2AJ-51P SPEC.1G
2AJ-51M SPEC.1G
205AJ-1P SPEC.1G
205AJ-1M SPEC.1G
B
2-JUMPERS
Nº160A144
TO SPARK
PLUG
MAGNETO
2-DUPLEX.
RECEPTACLES
Nº323P184...
M2
M1
A
COVER Nº330-42
BOX Nº Nº330-28
MTG. BRKT. FOR AK MODELS Nº301C1869
MTG. BRKT. FOR AJ MODELS Nº301C1870
ARMATURE
SHUNT FIELD
F-
F+
M2
M1
.1 MFD. COND.
Nº312A15
.5 MFD. COND.
Nº312A17
A.C. SLIP RINGS
120 VOLTS 1PH 2WIRE 50-60 CYS.
B ADD PART Nº
A REMOVED GROUND
REVISION
DATE
MATL WIRING DIAGRAM
D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA
DR. C.K.H.
CH. G.R.T.
AK-1P-1M-51P-51M SPEC.1H
AJ-1P-1M-51P-51M SPEC.1G
DATE 7-21-60
DWG. NO. 601889


601B90
102AK-52P SPEC.1H
102AK-52M SPEC.1H
105AK-2P SPEC.1H
105AK-2M SPEC.1H
2AJ-52P SPEC.1G
2AJ-52M SPEC.1G
205AJ-2P SPEC.1G
205AJ-2M SPEC.1G
STOP BUTTON
MOUNTED ON BLOWER
HOUSING
TO SPARK
PLUG.
MAGNETO
2-DUPLEX
RECEPTACLE
Nº323-213
M2
M1
A
BOX Nº330-28
COVER Nº330-42
MTG. BRKT. FOR AK MODELS Nº301C1869
MTG. BRKT. FOR AJ MODELS Nº301C1870
M2
M1
.1MFD. COND.
Nº312AS8
F-
SHUNT FIELD
F+
.5 MFD. COND.
Nº312A17
A.C. SLIP RINGS
230 VOLT 1PH. 2WIRE 50-60 CYS.
B
A
REVISED TERMINALS
REVISION
DATE
MATL WIRING DIAGRAM
D. W. ONAN AND SONS INC.
MINNEAPOLIS MINNESOTA
DR. C.K.H.
CH J.F.T.
AK-52P-52M-2P&2M SPEC.1H
AJ-52P-52M-2P&2M SPEC.1G
DATE 7-21-60
DWG NO 601B90


601B139
102AK-5IM114/1J
102AK-5IP114/1J
105AK-1M114/1J
105AK-1P114/1J
2AJ-5IM114/1H
2AJ-5IP114/1H
205AJ-1M114/1H
205AJ-1P114/1H
STOP BUTTON MOUNTED ON BLOWER HOUSING
TO SPARK PLUG.
MAGNETO
RECEPTACLE Nº323-195
REAR VIEW
115 VOLT LAMP Nº322A11
PILOT LIGHT GUARD Nº149-234
GASKET Nº149A156
CLAMP Nº301A1902
SOCKET Nº322-21
M1
M2
3-TWISTLOCK RECEPTACLES Nº323P140
COVER-Nº301C1901
BOX Nº301C1900
MTG. BRKT. Nº301C1870 FOR AJ MODELS
MTG. BRKT Nº301C1869 FOR AK MODELS
SHUNT FIELD
F+
F-
M1
M2
1 MFD. COND.
AC SLIP RINGS
120 VOLT 1PH, 2WIRE 50-60CY.
Onan DIVISION OF STUDEBAKER CORPORATION
8-26-65
CKN
G.F.T.
AK-1M114, 1P114, 5IM114, 5IP114/1J
AJ-1M114, 1P114, 5IM114, 5IP114/1H
601B139

601B137

102AK-51P SPEC IJ 102AK-51M SPEC IJ
105AK-1P SPEC IJ 105AK-1M SPEC IJ
2AJ-51P SPEC IH 2AJ-51M SPEC IH
205AJ-1P SPEC IH 205AJ-1M SPEC IH



LET	REVISIONS	ZONE	ENGR	DATE

Onan DIVISION OF STUDEBAKER CORPORATION Minneapolis Minnesota

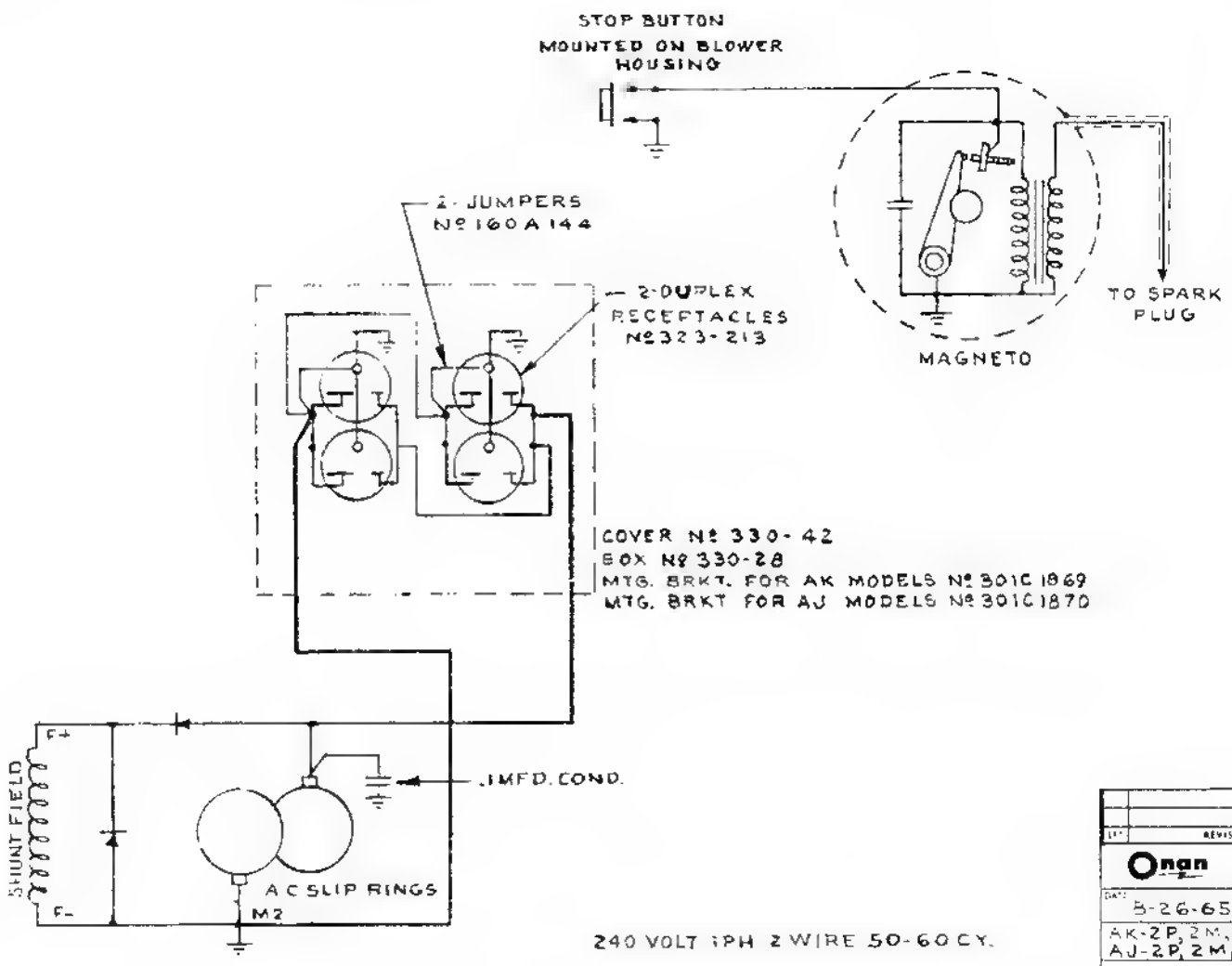
DATE	DR	ENGR	CKR	SC
8-26-65	CKH	G.F.T.		—

AK-1P-1M-51P-51M SPEC IJ
AJ-1P-1M-51P-51M SPEC IH

DWG NO 601B137

601B138

102AK-52P SPEC IJ
102AK-52M SPEC IJ
105AK-2P SPEC IJ
105AK-2M SPEC IJ
2AJ-52P SPEC IH
2AJ-52M SPEC IH
205AJ-2P SPEC IH
205AJ-2M SPEC IH



LTR	REVISIONS	ZONE	ENGR	DATE

Onan DIVISION OF STUDEBAKER CORPORATION

DATE	DR	ENGR	CHK	SC
3-26-65	CKH	GFT		—

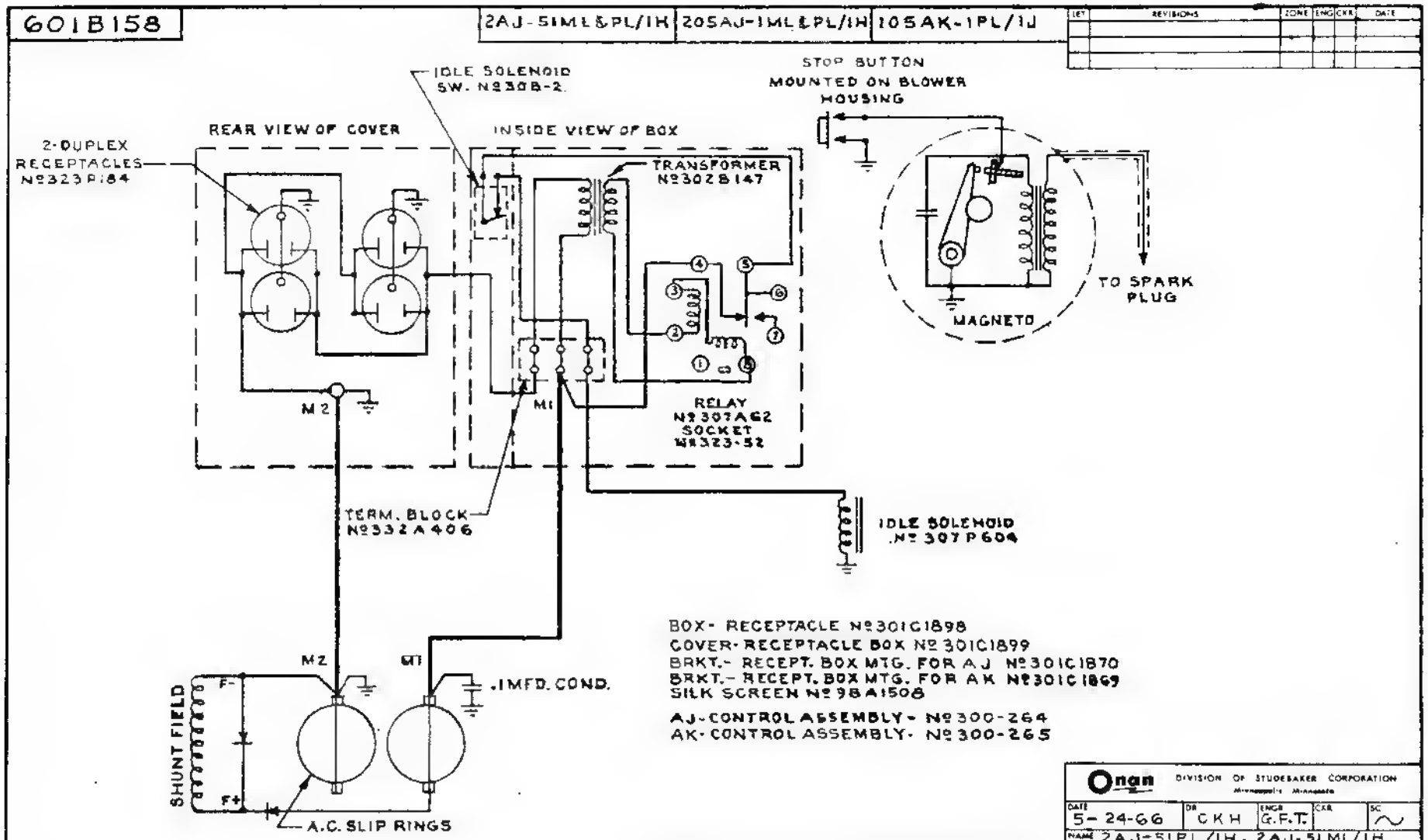
AK-2P, 2M, 5 2P, 5 2M SPEC IJ
AJ-2P, 2M, 5 2P, 5 2M SPEC IH

DWG NO 601B138

601B158

2AJ-51ML&PL/1H | 205AJ-1ML&PL/1H | 105AK-1PL/1J

LET	REVISIONS	ZONE	ENG	CKR	DATE



BOX- RECEPTACLE Nº301C1898
COVER- RECEPTACLE BOX Nº 301C1899
BRKT.- RECEPT. BOX MTG. FOR AJ Nº301C1870
BRKT.- RECEPT. BOX MTG. FOR AK Nº301C1869
SILK SCREEN Nº 98A1508

AJ- CONTROL ASSEMBLY- Nº300-264
AK- CONTROL ASSEMBLY- Nº300-265

120 VOLT 1PH. 2WIRE 50 CY. & 60 CY.

Onan DIVISION OF STUDEBAKER CORPORATION Minneapolis Minnesota

DATE	DR	ENGR	CKR	SC
5-24-66	CKH	G.F.T.		~

NAME 2AJ-51PL/1H, 2AJ-51ML/1H, 205AJ-1PL/1H, 105AK-1PL/1J

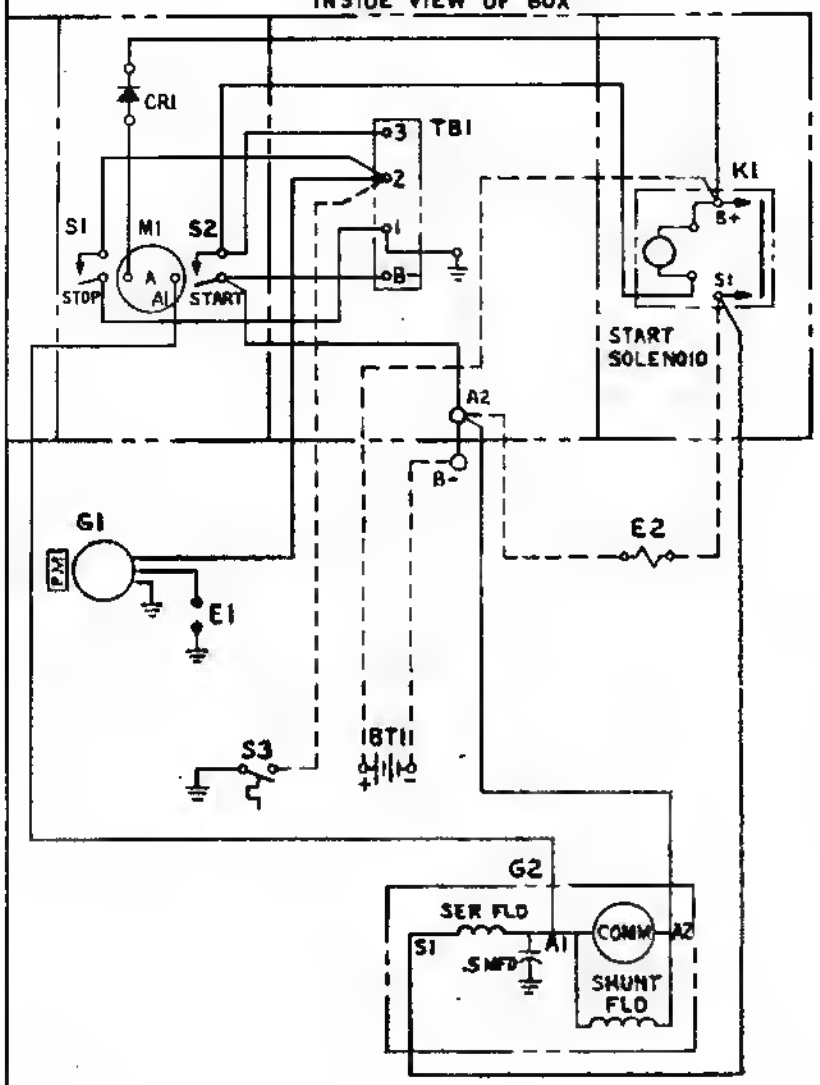
MODEL

DWG NO 601B158

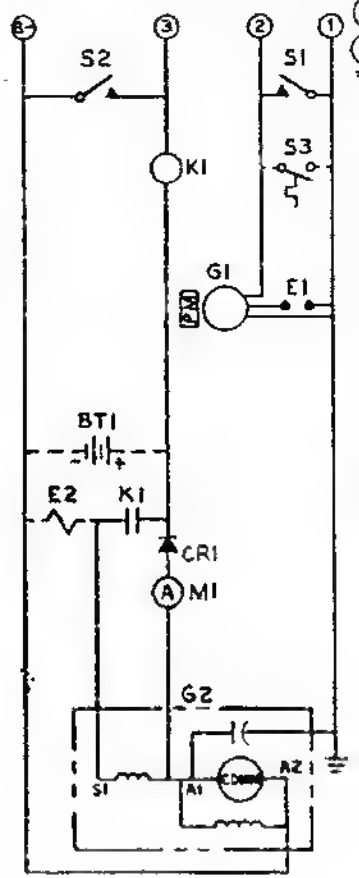
610B334

WIRING DIAGRAM

INSIDE VIEW OF BOX



SCHEMATIC



REF DES	PART NO.	QTY	DESCRIPTION
* BT1		1	BATTERY, 12V
C CR1	358A51	1	DIODE & HEAT SINK ASSY
	870P196	4	NUT - INSULATING, 8B
B	809-35	4	SCREW - RHSM #8-32, 3/4 LG
** E2		1	CHOKE-ELECTRIC
G1		1	MAGNETO
G2		1	GENERATOR
E1		1	SPARK PLUG
K1	30781046	1	RELAY-START SOLENOID
M1	302A62	1	AMMETER-CHARGE 45-0-45
S1	308-155	1	SWITCH-STOP
S2	308-155	1	SWITCH-START
** S3		1	SWITCH-HIGH TEMP CUTOUT
TB1	332A222	1	BLOCK-TERMINAL
	332A198	1	BRACKET-TERM BLOCK MTG
	301D3412	1	CONTROL BOX
	301C1858	1	COVER-CONTROL BOX
	98A1497	1	SILKSCREEN

*FURNISHED BY CUSTOMER
**WHEN USED

LET	REVISION	CK'D	DATE
C	CR1 WAS #358A40		10-4-71
B	ADDED 809-35 (4) SCREWS		3-25-71
A	MODEL WAS 0.6AK-212E/1L		3-25-71

Onan DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota

610B334

	MODEL NO	DATE	BY	CK'D
-01	0.6 AK-212 E/1M	3-19-71	CDR	
	12V REMOTE	NAME: CONTROL - GEN SET (WIRING DIAGRAM)		
		DWG NO: 610B334		

FORM 8A090